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ABSTRACT

This study explores the relationships between psychological types of users as identified by the Myers-Briggs Type Indicator and factors associated with the implementation and utilization of the Wisconsin System for Instructional Management (WIS-SIM), a computer management information system designed to support management processes in individualized programs of instruction. A theoretical framework and orientation to the study is given, highlighting developments in computer technology and in management information systems. An overview of the WIS-SIM is included, as are the study's significant contributions and its weaknesses. The research design, methods of measurement, and types of analysis employed are detailed, and an analysis of the data and a summary of the study are also provided. Appendices include the Myers-Briggs Type Indicator, as well as questionnaires and forms used in the study. (Author/RAO)

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Technical Report No. 454

AN INVESTIGATION OF PSYCHOLOGICAL TYPOLOGY AS AN INTERVENING VARIABLE IN THE IMPLEMENTATION OF A COMPUTER MANAGED INSTRUCTION SYSTEM

by

William C. Bozeman

Report from the Project on
Studies of Administration and Organization for Instruction

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Wisconsin Research and Development
Center for Individualized Schooling
The University of Wisconsin
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The Wisconsin Research and Development Center is supported with funds from the National Institute of Education and the University of Wisconsin.

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ABSTRACT

AN INVESTIGATION OF PSYCHOLOGICAL TYPOLOGY
AS AN INTERVENING VARIABLE IN THE IMPLEMENTATION
OF A COMPUTER MANAGED INSTRUCTION SYSTEM

William C. Bozeman

Under the Supervision of Professor Donald N. McIsaac

This study was part of a program of research on computer-supported management information systems in education. The purpose of the research was to investigate the implementation and utilization of the Wisconsin System for Instructional Management (WIS-SIM). Specifically, the study explored the relationships between psychological types of users and factors associated with the implementation and utilization of the system. These factors included apprehension of man-machine systems, confidence in WIS-SIM, and perception of usefulness of WIS-SIM.

Much of the conceptual foundation of this study embraced characteristics of management information systems. The primary theoretical framework was based on the Jungian theory of psychological types. The theory was considered appropriate when interfaced with the conceptual structure of management information systems and specifically the WIS-SIM system.

The independent variables were the four psychological type classifications proposed by Jung's theory. They represented four classificatory variables: extraversion/introversion, sensation/intuition, thinking/feeling, and judgement/perception. Classification of respondents was accomplished through administration of the Myers-Briggs Type Indicator. The dependent variables (apprehension of man-machine systems, confidence in WIS-SIM, and perception of usefulness of WIS-SIM) were measured by instruments developed by the researcher.

Data were collected from staff members of seven schools located in four Wisconsin school districts. These schools participated in the 1975-77 WIS-SIM pilot tests. Relationships between the independent and dependent variables were analyzed using multiple regression, correlational, factor analytic, and chi-square statistics.

The principal conclusions of the study were as follows:

1. A strong correlation was found between introversion and apprehension of man-machine systems.

2. Respondents who preferred using, as a mode of judgement, feeling as opposed to thinking, were associated with displaying greater apprehension of man-machine systems.

3. An association was found between extraversion and confidence in the system and between a thinking preference and confidence.

4. A high correlation was observed between extraversion and perceived usefulness of WIS-SIM.

5. Usefulness was strongly associated with users who had sensation and thinking preferences.

Based upon the findings and conclusions of this research, considerations were suggested for future research and development in management information systems and systems for computer management of instruction.

CHAPTER I

THEORETICAL FRAMEWORK AND ORIENTATION TO THE STUDY

Introduction to the Study

A major concern of many educators during the past fifteen years has been the interweaving of technological progress into the fabric of our schools. An approach to this concern which is not without merit is the analysis of innovations in business and industry and the management sciences in an effort to discern what they may offer education.

Most people, be they educators, engineers, or concerned parents of students, would agree, in varying degrees, that this is an admirable endeavor. Notwithstanding public reactions such as "back to basics", few would likely argue against a search for ways of improving education.

Although there certainly exist numerous examples of productive applications of industrial technology to education, there are many more examples of failure. This may be in large part due to zealous educators searching for the magic of industrial efficiency. Such a movement was most notable in the late 1960's and early 1970's when educational writers became enamored with "systems", "systems approaches," "systems analysis", and other related methodologies and techniques. The literature of this period abounds with references to operations research tools,

elementary systems models as typically represented by the proverbial "black-box" with an input and output and occasionally a feedback loop, techniques labeled with acronyms (e.g., PERT-CPM, CAI, CMI, PPBS, LP), and, less frequently, stochastic methods, queing theory, and Markov chains.

It is obvious now that some of the writers of this material were less knowledgeable about the applicability of these strategies than they professed to be. The result of this effort appears to be a lack of credibility on the part of many educators in the overall area of educational technology.

The intent of this discourse is not to criticize or judge the earlier attempts at the utilization of educational technology, but rather to provide a rationale for a more rigid framework for investigating the applications of technological concepts to education. To quote William Cunningham, a recent guest editor of Phi Delta Kappan, "...much too little is known or agreed upon concerning the development and impact of educational technology" (Cunningham, 1977, p. 462). Cunningham also quoted the Commission on Instructional Technology's report to the U.S. Congress. The ending words of this report are:

> In the conviction that technology can make education more productive, individual, and powerful, make learning more immediate, give instruction a more scientific base, and make access to education more equal, the commission

> concludes that the nation should increase its investment in instructional technology, thereby upgrading the quality of education, and, ultimately, the quality of individuals' lives and of society generally.

This study is a part of a program of research on computer supported management information systems in education. Specifically, the study is designed to investigate the implementation and utilization of the Wisconsin System for Instructional Management, a computer managed instruction system. The purpose of the study is to examine the relationships between psychological types of users of computer managed instruction and factors associated with the implementation and utilization of the system. These factors include apprehension of man-machine systems, confidence in the Wisconsin System for Instructional Management, and perception of the usefulness of the system.

This chapter provides an overview of the progress in computer technology; an analysis of management information system; a description of the Wisconsin System for Instructional Management; the theoretical framework of the study; a statement of the problem and hypotheses; and the significance and limitations of the study.

Progress in Computer Technology

Education is but one of the many areas of our society in which computer technology has invaded human activity. Electronic

computers, with their unprecedented power for processing enormous quantities of information at speeds incomprehensible to the human mind, have, and will continue to have, personal and psychological ramifications, as well as sociological and organizational consequences.

A complete discussion of the historical development of computing is clearly beyond the scope of this work. However, it is important to examine some of the major milestones in the development of computer technology in order to provide some perspective of what has occurred and what the immediate future may hold.

Automatic computing began in 1812 with Charles P. Babbage, an English mathematician, who wanted a machine that could execute complex calculations without any human intervention (Awad, 1968, p. 38). One of Babbage's better known contributions was the Difference Engine, a large adding machine designed to calculate mathematical tables. Because of the enormity of the device, it was never completed in its entirety as Babbage conceived it. Despite these obstacles, Babbage continued his work and in 1833 conceived the Analytical Engine. This machine would be able to add, subtract, multiply, and divide, and store its intermediate results in a memory. Although it was not fully completed, it was to be the first general purpose digital computer.

Another significant milestone was the invention by Herman Hollerith of the system of punched cards. Although a similar device had been developed earlier by Joseph Marie Jacquard of France, Hollerith's application of punched cards to speed the handling of data in the 1890 United States census resulted in a major event in the history of computing. Machines using this system completed the census in one-third the time required to calculate the previous 1880 census. Hollerith later formed the Tabulating Machine Company in 1896 which was absorbed in 1911 by IBM.

The first machine to utilize automatic computation similar to the dream of Babbage was the Automatic Sequence Controlled Calculator (ASCC). Completed in 1944 by Harvard and IBM scientists, the ASCC or Harvard Mark I was essentially a mechanical device for the preparation of mathematical tables (Adams & Haden, 1976, p. 30). It contained 760,000 parts and 500 miles of wire and used electro-mechanical relays for switching.

The first fully electronic computers were the ABC computer (Atanasoff-Berry Computer) constructed at Iowa State University in 1942, ENIAC (Electronic Numerical Integrator and Calculator) designed by John W. Mauchly and J. Presper Eckert at the University of Pennsylvania in 1945, and a German machine built at the German Aircraft Research Institute by Konrad Zuse in 1941.

Because much of Zuse's work went unpublished before World War II and because the most successful of his prototypic machines was destroyed in an air raid, much of his work has gone unrecognized (Hawkes, 1971, p. 32).

ENIAC was constructed primarily to produce ballistic weapons tables during World War II but was not completed in time to be utilized in the war effort. ENIAC was a massive device requiring over 18,000 vacuum tubes (mostly double triodes), 1500 square feet of floor space, 1500 relays, miles of wire, and weighing more than 30 tons. Having these components operational for the time required to complete a computation was a feat in itself. Another drawback of ENIAC was the fact that it had to be physically wired to perform a particular task. Reprogramming required changing hundreds of plug and socket connections and considerable time.

A principal figure in the development of computer technology was Dr. J. von Neumann, a mathematician upon whose ideas the concept of the stored program is based. As a result of von Neumann's theories, the EDVAC (Electronic Discrete Variable Automatic Computer) was developed. EDVAC used a stored program which controlled the sequential operations of the computer and paper tape for input. So profound were von Neumann's ideas, he is often accorded the title "father of the stored-program concept"

(Adams & Haden, 1976, p. 35). Von Neumann also made numerous other contributions to the field including the development of the MANIAC (Mathematical Analyzer, Numerical Integrator, and Computer) which enabled the United States to produce and test the first hydrogen bomb in 1952.

The first commercially available computer was UNIVAC I (UNIVersal Automatic Computer) built by the Eckert and Mauchly Computer Company (the same team who built ENIAC). In 1951 it was used to work on the 1950 U.S. census. Their company was purchased by Remington Rand and subsequently became the Univac division of Sperry Rand.

The computers built between UNIVAC I and the later 1950's are typically characterized as first-generation computers. The identifying characteristics of these computers were use of vacuum tubes, and machine-language programming techniques, large size, considerable power requirements, and a need for powerful environmental control devices due to the heat generated by the banks of vacuum tubes. The more widely known first-generation computers included ENIAC, EDVAC, MANIAC, MADAM (Manchester Automatic Digital Machine), SEC (Simple Electronic Computer), and the IBM 701 and 650 computers.

Revolutionary concepts in the entire field of electronics as well as the area of computing were witnessed in 1948 with the development of the transistor by Bell Laboratories. The advent

of the transistor occurred almost simultaneously with the stored-program digital computer. The synergistic effect of a new component and a new application resulted in an explosive growth of both (Noyce, 1977, p. 63).

The use of transistors in place of vacuum tubes in computers marked the beginning of second-generation computers. These computers were much smaller than their predecessors, required less power and environmental systems and possessed increased efficiency, speed, and reliability. The most popular second-generation machines were the IBM 1401 business-oriented computer and the IBM 1620 scientific-oriented computer. The IBM 7090-7094 dominated the large-scale computer applications (Adams & Haden, 1976, p. 37).

Third-generation computers appeared in 1965. These machines were characterized by the use of integrated circuits, increased programming and peripheral sophistication, and overall miniaturization of hardware (Awad, 1968, p. 45). Examples of third-generation computers include IBM's System/360 and Control Data Corporation's 3600, 6400, and 7600 computers.

The "integrated" circuit, which provided this decrease in size and increase in computing power, consisted of thousands of electronic components on a single chip. The impact of this concept of electronic circuitry cannot be overstated. Gordon E. Moore, former director of research at Fairchild where the

monolithic integrated circuit was invented, predicted in 1964 that the number of elements in advanced integrated circuits would double every year. The circuits presently available show little departure from Moore's law (Noyce, 1977, p. 65). This growth is depicted graphically in Figure 1.

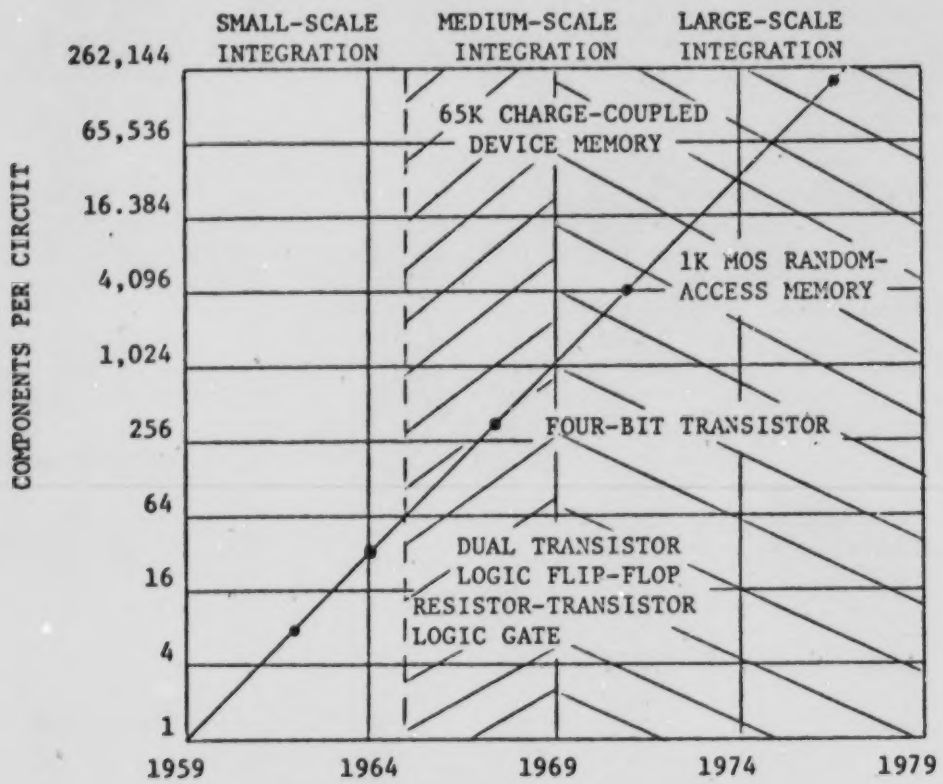

Figure 1. Increase in Number of Components Per Circuit

The momentum of circuitry miniaturization and microelectronics was carried one more step forward in the early 1970's with the development of microprocessors. A microprocessor is a

silicon-based chip or wafer, easily held in the palm of one's hand, which contains thousands of integrated circuits.

The advent of the microprocessor marked the beginning of a new computer revolution (Sippl, 1977, p. 4). These integrated circuit chips are often 1/4 inch square but have computing and memory power greater than the 30 ton ENIAC. Within the chip are the components of a central processing unit. They are low in cost (less than 50 dollars and as low as a few dollars), reliable, and durable.

Microprocessors constitute the nucleus of the microcomputer. When the microprocessor is coupled with main and auxiliary memories as well as other peripheral equipment, a small but very powerful computing system results. It is difficult to imagine any part of our life and society which will not be affected in some way by this technology.

The growth rate of computer technology is an interesting phenomenon. Throughout the history of computers, people have been, and continue to be, somewhat doubtful and skeptical of their utility and abilities. As more and more applications and technological breakthroughs occur, previous estimates of computing needs become obsolete. The synergy which exists between the technology itself, societal needs, and economics has resulted in a growth that defies prediction. It is interesting to note that the developers of the first computers felt that

four computers, more or less, would satisfy the world's computational needs (Noyce, 1977, p. 64). Table 1 provides some indication of the inaccuracy of this estimate.

TABLE 1

COMPUTER GROWTH IN U.S.

YEAR	APPROXIMATE NUMBER OF COMPUTERS IN U.S. ALONE
1950	15
1951	100
1956	1000
1961	9500
1966	40,000
1972	100,000
1975	200,000

The widespread prevalence of microcomputers which appears inevitable in the immediate future may completely alter the trend depicted by the graph in Fiugre 2. The costs associated with computing and the hardware itself may well follow the pattern of the pocket calculator. In fact, it is not unreasonable to assume that by 1985 a complete microcomputer which will interface with an ordinary television for display will cost less than one hundred dollars.

Graphically, this may be represented as in Figure 2.

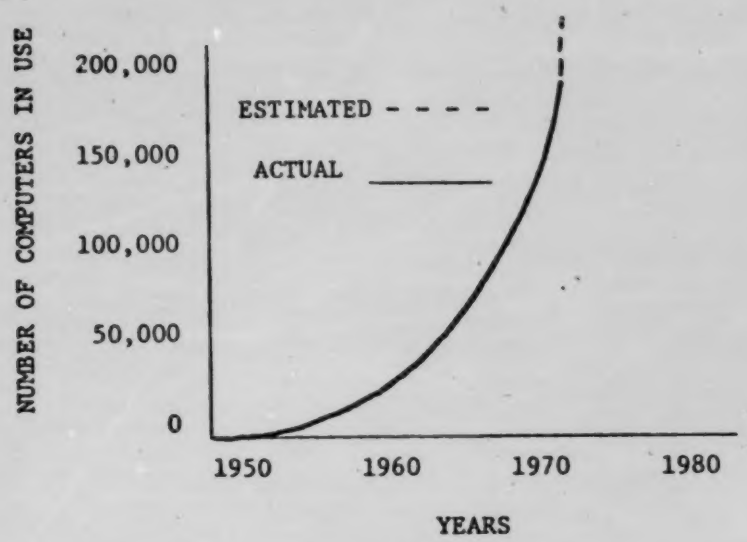

Figure 2. Number of Computers in Use

SOURCE: Donald D. Spencer, Computers in Society (Rochelle Park, New Jersey: Hayden Book Company, 1974), p. 3.

Education has not been insulated from this progress and has clearly felt its thrust. Computer applications on the educational scene became prevalent in the 1960's with information systems for accounting and record keeping being among the initial uses, followed by limited applications to instruction. Numerous educational applications of the computer have since been researched and developed including computer assisted instruction, computer managed instruction, enrollment projection, student assignment, bus routing, student scheduling, resource and material optimization, and management.

Computer assisted instruction (CAI) has been an item of interest and controversy for over ten years. Although there exist different definitions of CAI, the classical concept is that of the student interacting with a computer via a printer or cathode ray tube (CRT) display for the purpose of obtaining some form of programmed instruction. Certain assumptions about the nature of CAI are also generally accepted including:

1. Instruction is machine centered unless certain material or concepts are not being conveyed. At this time a human teacher enters the instructional process.
2. Learning takes place at the student's own rate.
3. Immediate feedback is provided.
4. Individualization is achieved by allowing the student to communicate in a one-on-one mode with the teacher.

The model in Figure 3 incorporates the elements which typically exist in CAI.

Computer managed instruction (CMI) seeks to facilitate the processing of information and to supply this information at appropriate times and places so that it is applicable to instructional decision making (Spuck, Bozeman, & Lawrence, 1977, p. 3). CMI is not a curricular program as are programs in CAI. CMI qualifies as a management information system as will be addressed in the following section. The Wisconsin

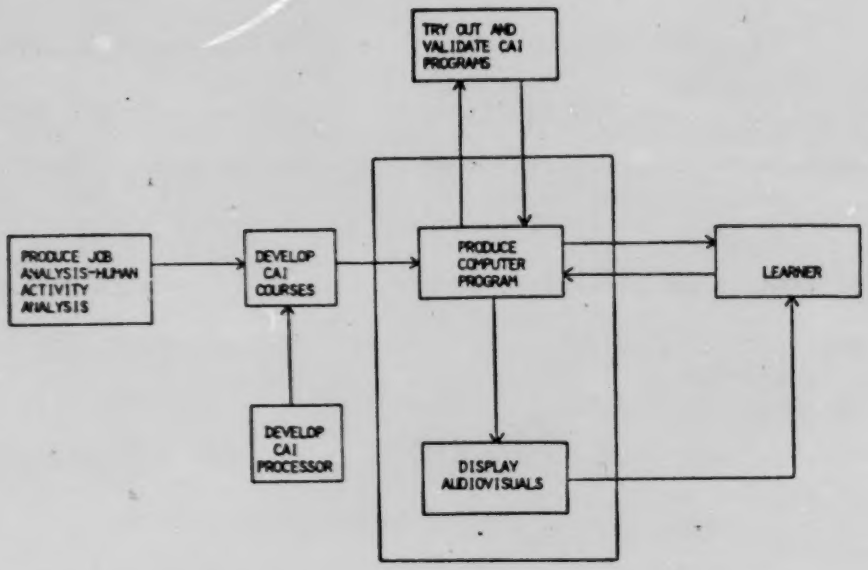

Figure 3. Model Describing Computer Assisted Instruction

SOURCE: The Diebold Group, Inc., ed., Automatic Data Processing (New York: McGraw-Hill, 1977), p. 8-11.

Computer managed instruction (CMI) seeks to facilitate the processing of information and to supply this information at appropriate times and places so that it is applicable to instructional decision making (Spuck, Bozeman, & Lawrence, 1977, p. 3). CMI is not a curricular program as are programs in CAI. CMI qualifies as a management information system as will be addressed in the following section. The Wisconsin System for Instructional Management is a particular program of CMI and will be discussed in detail in a separate section.

This section has attempted to present the reader with a brief overview of the history and progress of computer technology with the purpose of generating a perspective of the incredible momentum witnessed during the past few years. Given this perspective, it may be possible to envision what could be in the very immediate future. The computer is a powerful instrument and its effects on society and on education, in particular, will be far-reaching. There is much yet to be understood about person-computer interaction. There certainly exist many negative attitudes about computers and direct hostility in many cases. This is in large part due to a void in the education of our society about computers.

If the computer is to become a dynamic component of the educational process, much effort will be required to address the fears and concerns about this technology. Equally important is the need for an understanding of the interaction between people and computers and the maximization of this interaction in order to enhance the goals of our society.

Management Information Systems

Although this research is focused on the implementation of a computer managed instruction system, much of the conceptual framework embraces certain characteristics of management information systems. Because there exists less than universal

consensus as to what a management information system is and because it can be viewed and analyzed from many sides, this section will address management information systems for the purpose of suggesting certain basic definitions, concepts, and principles.

A search of the literature related to management information systems reveals little agreement as to the meaning of the term. The use of the word "system" immediately introduces the possibility for numerous interpretations. A reasonable approach to deciphering the meaning of "management information system" is the analysis of the term word-by-word. Since the noun "system" is being modified and described and since it is among the most ambiguous and ubiquitous words in current literature, let us first consider its meaning.

A simple and general definition of "system" was provided by Lundeberg: "A system is a collection of objects (elements), called parts which are correlated in some way (have some kind of connection)" (Lundeberg, 1970, p. 4).

Harrison indicated that one may view a system as "something which has an input and an output, or, as something which makes outputs out of inputs" (Harrison, 1977, p. 2). Kanter used Webster's definition of a system as "a set or arrangement of things so related or connected to form a unity or organization," (Kanter, 1977, p. 14). Nadler defined a system to be "the

specified and organized conditions for the elements of function, inputs, outputs, sequence, environment, physical catalysts, and human agents detailed for each element in physical, rate, control, and state dimensions." (Nadler, 1970, p. 41). These definitions and others possess commonality in that they refer to a system as having certain elements, though the preciseness of their specification may vary, and that these elements may interact for a purpose such as the conversion of inputs to outputs.

The concept of information was approached by Kneitel (1976, p. 95) through the principle of taxonomy. Information results by taking data (the smallest building blocks of measurable occurrences) and restructuring them into an array of logical and similar categories. Mason and Mitroff generically defined information as "knowledge for the purpose of taking effective action" (Mason & Mitroff, 1973, p. 475). Unfortunately, such a generic definition raises many problems such as what is meant by "knowledge," "purpose," "effective," and "action." These terms may vary in meaning depending on the situational context and the person. For example, what is information for one person will not necessarily be information for another. Information, in the context of this study, appears adequately defined by Kanter as "processed data" (Kanter, 1977, p. 10). This concept of information is similar to that of Kneitel with the

introduction of processing as a technique for developing a taxonomy. This may be illustrated as in Figure 4.

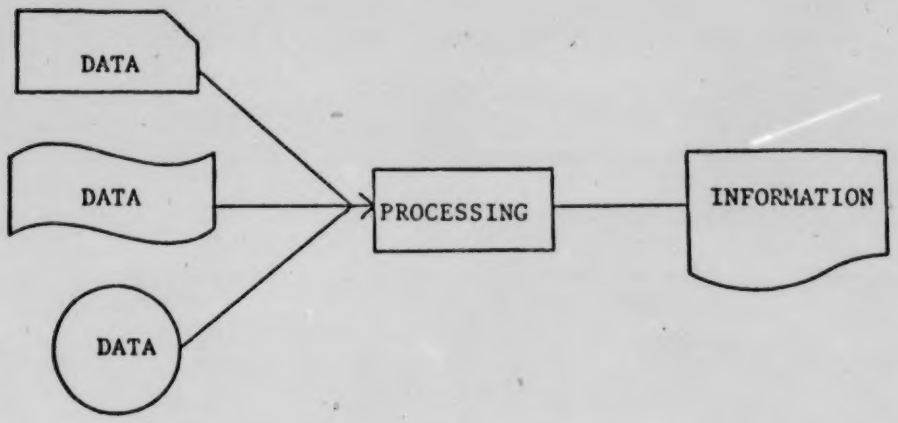

Figure 4. Information as Processed Data

Management refers to the collective body of individuals responsible for functions including planning, organizing, staffing, directing, coordinating, reporting, and budgeting (Gulick & Urwick, 1968, p. 27). These management functions include decision making within an organizational context. These management problems may also be structured or unstructured. The organizational context may be strategic planning, management control, or operational control. Anthony (1965, p. 483) defines these levels of the organizational context as follows:

(1) Strategic planning - the process of deciding on objectives of the organization, on changes in these objectives, on the resources used to attain these

objectives, and on the policies that are to govern the acquisition, use, and disposition of these resources.

(2) Management control - the process by which managers assure that resources are obtained and used effectively in the accomplishment of the organization's objectives.

(3) Operational control - the process of assuring that specific tasks are carried out efficiently and effectively.

Given the perspective provided by the three definitions of the words, the term "management information system" can be viewed in totality. A management information system (MIS) is a set of correlated elements which serve the purpose of processing data to provide information that may assist the management functions. An alternative definition of a MIS is provided by Mason and Mitroff (1973, p. 475).

> An information system consists of at least one person of a certain psychological type who faces a problem within some organizational context for which he needs evidence to arrive at a solution (i.e., to select some course of action) and that evidence is made available to him through some mode of presentation.

The MIS may or may not be computer supported. However, considering the voluminous data inherent in most medium to large scale operations, the need for computer support becomes

obvious. If the system is to be accurate, responsive, and capable of handling a wide variety of applications, some aspect of electronic processing must be employed. Demands on clerical staffs in situations involving large quantities of data also suggest the use of electronic processing equipment.

The concept of the MIS emerged in the early sixties and has demonstrated an evolutionary development since that time. Early systems were designed in the absence of direction and understanding about the complexities of integrating the MIS into the context of the organization. The first phase in the early to mid-sixties was characterized by great enthusiasm and optimism. The second phase, from the late sixties to the early seventies, was marked by considerable disappointment. The phase in which we find ourselves now is characterized by cautious reappraisal and implementation of the basic concepts (Diebold Group, 1977, pp. 1-14).

Most writers in the field of information systems agree that many of the problems and failures of MIS can be traced to lack of management involvement and understanding. This is in part due to the potential for variance in complexity, application, and utilization of the MIS. The system may be little more than an accounting or record-keeping device such as the bank teller may access prior to cashing a check or making a savings account withdrawal. An application of similar complexity

in education would be a system for storing student records or student achievement data which could be accessed by the faculty or administration. Although these examples may be more or less complex depending upon the provisions for updating records (e.g., on-line information retrieval and updating capabilities as opposed to periodic batch processing), record access time, mode of presenting information, and storage limitations, they nevertheless represent only record-keeping devices. At best, they represent a low-level MIS or perhaps more accurately, an "information management system."

The MIS could also be a more sophisticated system providing the corporate executive with external environmental, economic, demographic, social, technical, and competitive data, internal financial and operational company data, as well as the potential for easy information retrieval and analytical processing, such as trend, statistical, or graphic analysis. The nature of the MIS and its decision support capabilities, therefore, can essentially represent two extreme points of view: conservatively, the MIS may provide only certain basic information, leaving management by itself to make the decisions, or, more radically, the system may move from operational to strategic decision making (Hawkes, 1971, p. 38).

As discussed previously, the levels of operational and strategic decision making correspond respectively to the lowest

and highest levels of decision making in the organization. A third level, tactical or management decision making, which exists between operational and strategic may be considered also (Diebold Group, 1977, p. 3-20). Although the boundaries and distinctions between the levels of organizational decision making are ill-defined, they may be viewed as presented in Figure 5. The associated information requirements are included with the respective levels.

Each of these three levels clearly possesses certain unique information requirements (although there is overlap and necessity for sharing common information). Those members of each level in the organization, therefore, require different evidence to arrive at decisions or solutions, possibly in a different format and through a different mode of presentation. Put another way, different organizational contexts require different management information systems.

It is obvious that a MIS can be a difficult concept with which to deal as it may be viewed in many ways. As stated earlier, this lack of understanding has contributed, in part, to many of the failures of MIS implementation and utilization. This section began by examining the definition or meaning of MIS. Given this foundation, the application of a system for meeting the information requirements of the management or decision levels of the organization was addressed. This may be summarized

DECISION LEVEL	CHARACTERISTICS	INFORMATION REQUIREMENTS
STRATEGIC	1. UNSTRUCTURED PROBLEMS AND DECISIONS 2. REQUIRE MULTIPLE ORGANIZATIONAL UNIT/ PERSONNEL INPUT 3. ENCOMPASS LONG TIME DIMENSIONS 4. INFREQUENT AND OFTEN NON-REPETITIVE 5. CONCERN ESTABLISHMENT OF POLICIES, PLANS, OBJECTIVES, AND BUDGET OF THE ORGANIZATION 6. BROAD SCOPE OF ACTIVITIES	1. HIGHLY AGGREGATED INFORMATION 2. TYPICALLY LOW IN VOLUME 3. RELIANCE ON EXTERNAL DATA 4. INFORMATION IS GENERALLY MORE PREDICTIVE THAN HISTORICAL IN NATURE 5. REQUIREMENTS FOR TIMELINESS AND ACCURACY ARE LESS SEVERE
TACTICAL (MANAGEMENT)	1. PROBLEMS AND DECISIONS ARE MORE STRUCTURED; VARIABLES BETTER DEFINED 2. PLANNING FOCUSES ON SHORTER TIME PERIOD 3. SPECIFIC TASKS TEND TO BE MORE FREQUENT AND REPETITIVE 4. CONCERN IMPLEMENTATION PROCEDURES AND EVALUATIVE MEASURES	1. ADDRESSES SPECIFIC NEEDS 2. PRIMARILY INTERNAL DATA 3. ACCURACY AND TIMELINESS ARE IMPORTANT 4. MORE DETAIL IS REQUIRED
OPERATIONAL	1. HIGHLY STRUCTURED AND WELL-DEFINED PROBLEMS AND DECISIONS 2. SHORT PLANNING HORIZON 3. TASKS INVOLVE PRODUCTION, SERVICES, OR PERFORMANCE 4. DECISIONS ARE REPETITIVE AND FREQUENT	1. ADDRESSES SPECIFIC AND IMMEDIATE NEEDS 2. INTERNAL DATA 3. MUST BE EXACT AND TIMELY 4. TYPICALLY TENDS TO BE DETAILED AND VOLUMINOUS

Figure 5. Levels of Decision Making and Associated Information Requirements

by examining eight pertinent characteristics of a MIS as defined by Kanter (1977, pp. 22-25).

1. Management oriented - system development starts from an appraisal of management needs and organizational objectives.
2. Management directed - management is responsible for directing system development and continued review of system specifications and evaluation.
3. Integrated - information from multiple operational areas is blended, thereby interfacing organizational subsystems.
4. Common data flows - degree to which data is derived from a common data path must be closely examined to determine desirability of design concepts.
5. Heavy planning element - future objectives of the MIS must be considered in planning to avoid obsolescence before the system is operational.
6. Subsystem concept - identification of organizational components may assist in the phasing plan for MIS implementation.
7. Central data base - one master file may provide the data required by any of the functional systems.
8. Computerized - although it is possible to have a MIS without computer support, the management requirements

of most present-day organizations would necessitate the capabilities available only through computer support.

Given the framework and concepts related to a MIS, the next section will attempt to demonstrate that the Wisconsin System for Instructional Management computer managed instruction system qualifies as a MIS.

The Wisconsin System for Instructional Management

As previously indicated, the management information system which will be utilized as a vehicle for this research is the Wisconsin System for Instructional Management (WIS-SIM), a computer managed instruction system. This section will present general information about computer managed instruction, the framework and design of WIS-SIM, its development and applications, and its contemplated future.

The development of computer managed instruction (CMI) programs began in the late 1960's. Baker (1978) presents an excellent overview of this development as well as a discussion of several CMI systems such as Teacher Information Processing System (TIPS), Program for Learning in Accordance with Needs (PLAN), and Managed Instruction with Computer Assistance (MICA). He also cites three themes in American education which have contributed to the development of CMI:

1. Individualization - Educators have demonstrated an intuitive feeling about the existence of means to meet the instructional needs of individual students. Individualization of schooling has been a primary motivation in most CMI development.
2. Behavioral objectives - Student behavior or performance (typically in the cognitive domain) is specified in precise terms as part of the curricular structure. This is usually accompanied by some specification of time, means, and evaluative measures.
3. Educational technology - The impact and progress of technology has been closely scrutinized by educators for instructional potential. The primary focus of attention in recent years has been on computer utilization.

CMI is an excellent device for incorporating the needs educators have expressed with regard to individualization of instruction. One of the most obvious applications is computerized record keeping systems to handle the increased data generally associated with individualized instruction. The potentials of CMI, as with the MIS, can extend far beyond this mode of application.

WIS-SIM is a MIS designed to support management processes in individualized programs of education, especially programs being conducted in accordance with the precepts of Individually

Guided Education (IGE). IGE is a comprehensive system of education designed to produce higher educational achievements through the provision for individual differences between students in areas such as rate of learning and learning style. An especially important component of IGE for the design of WIS-SIM is the instructional programming model.

The instructional programming model (Figure 6) assumes the existence of a set of measurable objectives for a curriculum area. It is designed to take into account the pupil's beginning level of performance, rate of progress, style of learning, and other characteristics important in the context of the educational program of the school. Two curriculum components developed at the Wisconsin Research and Development Center which use this model as a basis are Developing Mathematical Processes (DMP) and the Wisconsin Design for Reading Skill Development (WDRSD) (Spuck, Bozeman, & Lawrence, 1977, p. 2). An extensive discussion of IGE and these two curriculum components is provided in a book edited by Klausmeier, Rossmiller, and Saily (1977).

Programs of individualized schooling are more complex in design and operation than conventional programs. The teacher's task of tracking the students' progress as they move through modules and objectives in several curricular components is clearly not a trivial problem. In addition, the teacher must assess initial performance levels, make diagnoses, select

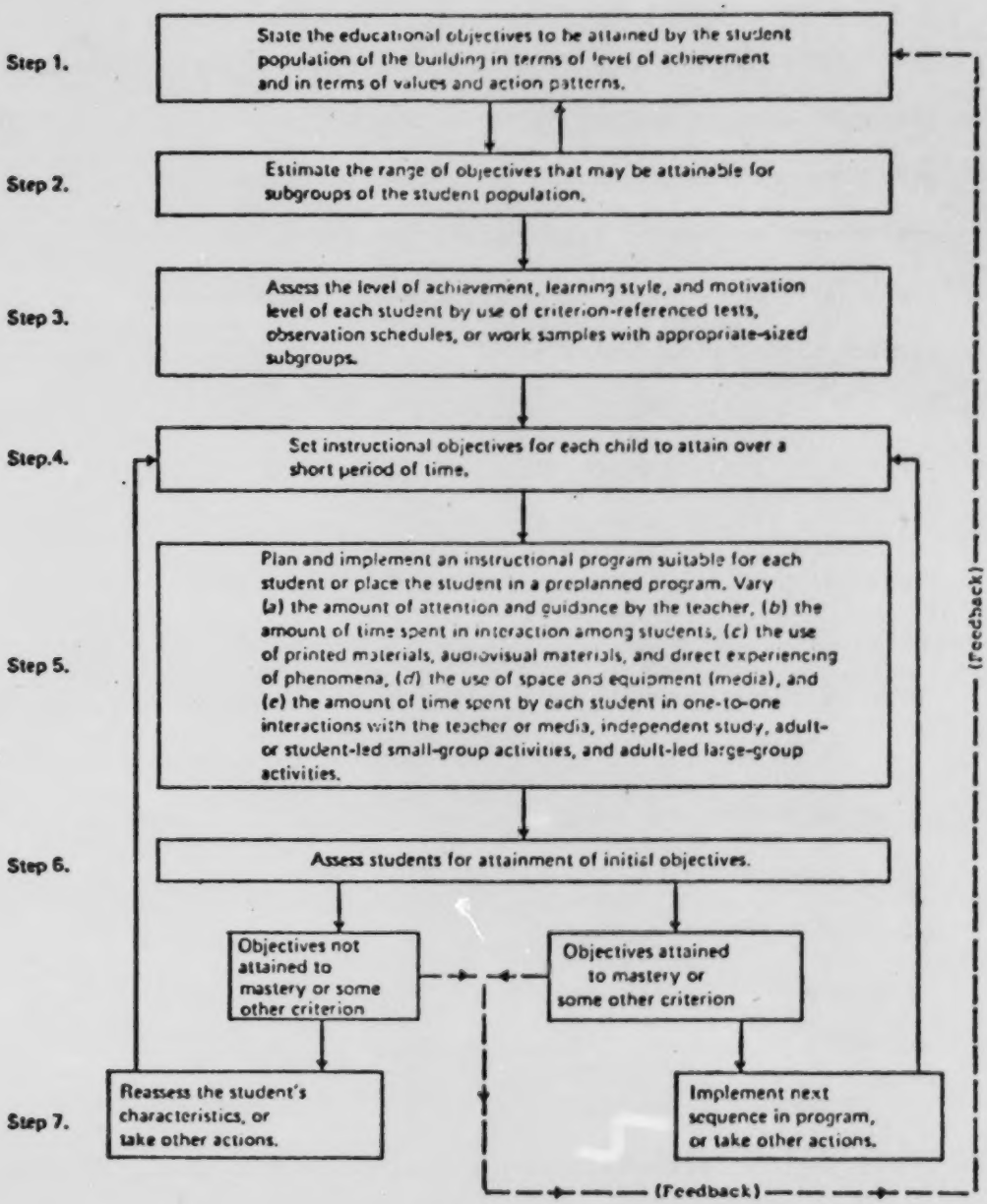
Step 1.
State the educational objectives to be attained by the student population of the building in terms of level of achievement and in terms of values and action patterns.
Step 2.
Estimate the range of objectives that may be attainable for subgroups of the student population.
Step 3.
Assess the level of achievement, learning style, and motivation level of each student by use of criterion-referenced tests, observation schedules, or work samples with appropriate-sized subgroups.
Step.4.
Set instructional objectives for each child to attain over a short period of time.
Step 5.
Plan and implement an instructional program suitable for each student or place the student in a preplanned program. Vary (a) the amount of attention and guidance by the teacher, (b) the amount of time spent in interaction among students, (c) the use of printed materials, audiovisual materials, and direct experiencing of phenomena, (d) the use of space and equipment (media), and (e) the amount of time spent by each student in one-to-one interactions with the teacher or media, independent study, adult- or student-led small-group activities, and adult-led large-group activities.
Step 6.
Assess students for attainment of initial objectives.
Objectives not attained to mastery or some other criterion
Objectives attained to mastery or some other criterion
Step 7.
Reassess the student's characteristics, or take other actions.
Implement next sequence in program, or take other actions.
(Feedback)
(Feedback)

Figure 6. Instructional Programming Model in IGE

(Adapted from Klausmeier, Quilling, Sorenson, Way, & Glasrud, 1971, p. 19).

appropriate instructional strategies, and administer tests to ascertain the students' academic achievements.

Although these processes and tasks can be accomplished through manual operations, it seems evident that the effectiveness and efficiency of time usage and decision making can be enhanced through an automated system. WIS-SIM seeks to facilitate the processing of information and to supply this information at appropriate times so that it is directly applicable to instructional decision making. The instructional cycle in programs of individualized instruction may be defined as including five processes and two decision areas. Initially, testing, designed to provide placement information about students, is carried out (Process 1). These tests are scored (Process 2) and the results compared with mastery or performance levels which have been specified for each student and for each instructional objective. Diagnosing (Process 3) defines the area of instructional need in each area of the curriculum. This process of diagnosing provides information leading toward the identification of instructional needs (Decision 1). Prescribing or guiding (Process 4) is designed to provide information useful in selecting those instructional activities (Decision 2) which are most appropriate for meeting the student's instructional needs. The activities selected are carried out during instruction (Process 5) after which testing (Process 1) again takes place to determine if the

student has achieved the given objectives (Spuck, 1975, p. 23). The instructional cycle in individualized education is presented in Figure 7.

The basic structure of programs of individualized instruction (e.g., IGE) leads to the following assumptions concerning instructional programs which may be supported by a CMI system such as WIS-SIM:

1. There exist instructional missions and goals which are reduced to sets of measurable instructional objectives;
2. Testing instruments and/or procedures which may be used to assess mastery of the instructional objectives are available;
3. Level(s) of mastery or performance standards are specified for each child and for each instructional objective (full mastery-variable attainment);
4. Objectives which are to form a part of each student's instructional program are delineated (common objectives--variable objectives);
5. Dependencies existing between objectives are specified (sequenced objectives--nonsequenced objectives);
6. Normative information exists, as required, for input into the specifying long-range performance expectations.

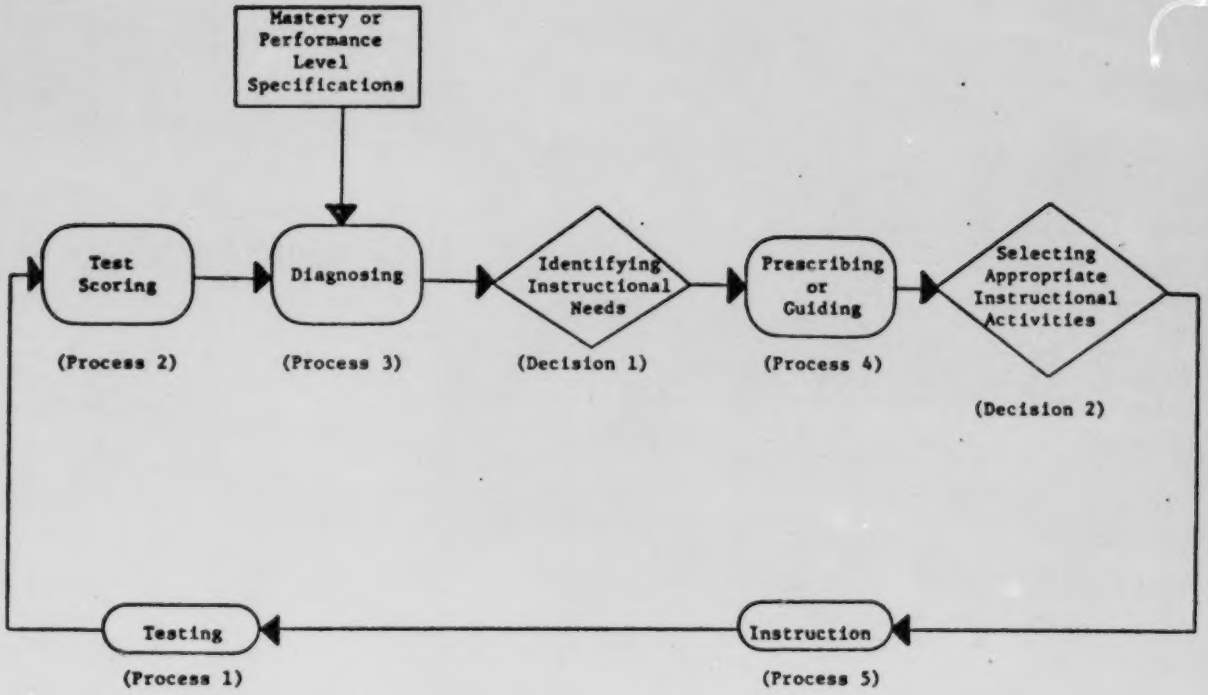

Figure 7. Instructional Cycle in Individualized Education
(Adapted from Dennis W. Spuck et al, Computer Management of Individualized Instruction (Madison: Wisconsin Research and Development Center, 1975), p. 23)

7. Educational activities and materials exist which provide individualized instructional experiences toward the accomplishment of the specified instructional objectives;
8. It is possible quantitatively and/or qualitatively to assess the individual characteristics of students essential to individualizing instructional activities;
9. It is possible quantitatively and/or qualitatively to assess the resource implications of alternative educational experiences (Belt & Spuck, 1975, p. 9).

Given these basic assumptions regarding the instructional program, six goals were given primary emphasis in the design and development of WIS-SIM (Belt & Spuck, 1975, p. 22):

1. To facilitate the learning environment for each child in terms of the instructional and organizational requirements of IGE;
2. To provide information which is useful to educational decision makers at the unit, school, and district levels;
3. To improve communications with parents and upgrade the quality of reporting to them about student achievement;
4. To make minimal demands on teachers to "learn" the system;
5. To make minimal demands on teachers to perform tasks which are different from normal classroom activities

and, where possible, to reduce the paper work requirements of school personnel;

6. To make computer management of instruction available to a large number of IGE schools;
7. To accommodate a broad range of instructional programs which are compatible with the Instructional Programming Model of Individually Guided Education.

Figure 8 presents WIS-SIM as a model in diagrammatic form. The model incorporates the five processes and two decisions of the instructional cycle as well as the process of achievement profiling and the data bases.

The design of WIS-SIM permits operation in the interactive mode in which all data input, report requests, updates, and status changes are entered using the computer terminal. This terminal is located in the school and communicates with the main computer via the public telephone system. Printing of the reports can be done on the terminal or at another site on a high-speed printer. The general configuration of WIS-SIM is presented in Figure 9.

The design of the WIS-SIM does not require any technical knowledge of computing on the part of the school staff. The computer terminal operator typically requires approximately one to two hours inservice training regarding the terminal procedures and system dialogue. In most applications, the operator will be

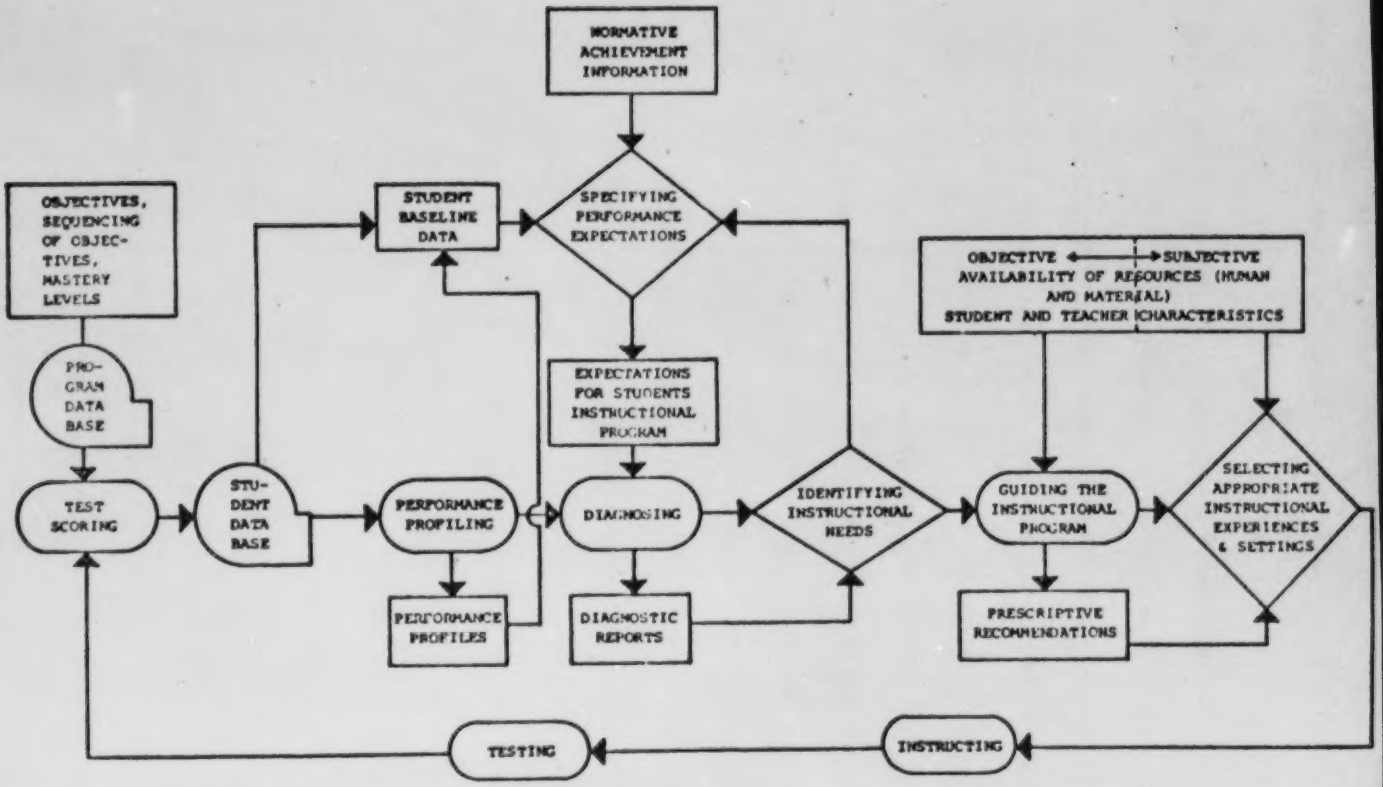

Figure 8. Wisconsin System for Instructional Management (WIS-SIM) Model

SOURCE: Belt and Spuck, Design Specifications for the Generalized Wisconsin System for Instructional Management, p. 14.

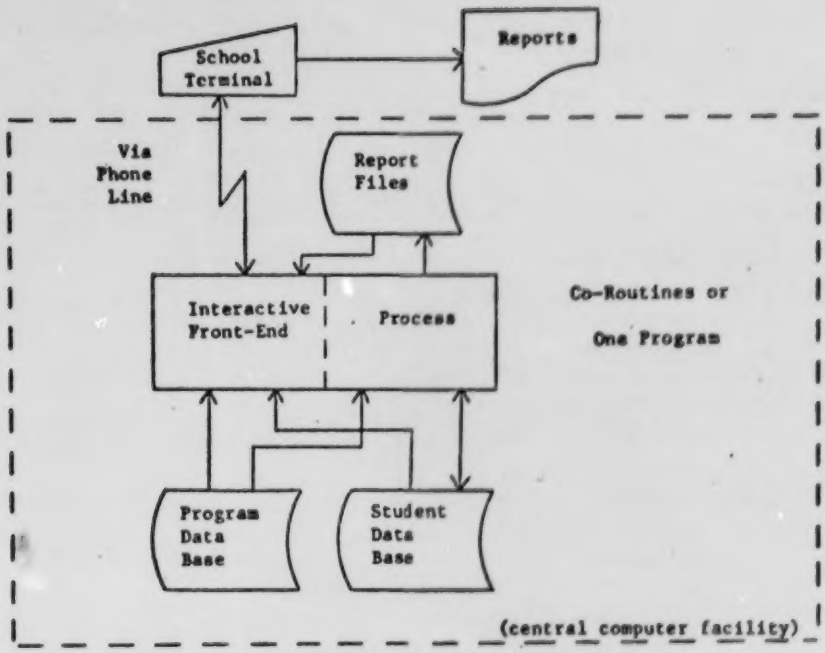

Figure 9. Interactive Configuration of WIS-SIM

SOURCE: Bruce G. Douglas et al., System Design Manual for the Unified Wisconsin System of Instructional Management (Madison: Wisconsin Research and Development Center, 1977), p. I-37.

a teacher aide to whom the teacher submits data and report requests.

The following elements of the instructional process have been identified in WIS-SIM:

1. Assessing Instructional Outcomes/Updating Student Records

   Allows for the submission of assessment information and updating of the student data base files which

contain individual student performance and demographic data.

2. Identifying Instructional Needs

   Teachers can receive lists of their students with a computer stored record of their progress. These lists can be of entire units or specific individual students. The format of the individual reports also allows them to be used in reporting to parents. Both the unit and individual reports can be tailored to report progress for a teacher specified range of objectives within an instructional program.

3. Grouping Students for Instruction

   Instructional groups can be formed on the basis of the instructional needs previously identified. This is accomplished by searching a particular group of student records (usually a unit or class) and listing those who are, those who are not, as well as a summary report listing student eligibility totals over a range of modules.

Functional capabilities provided by WIS-SIM include:

1. Program data base initiation
2. Student data base initiation
3. Entering student achievement data
4. Achievement profiling

5. Instructional grouping recommendation and implementation
6. Diagnostic reporting
7. Student data base maintenance
8. Monitoring overlap between instructional programs
9. Data base purging
10. Curriculum and program evaluation.

In summary, WIS-SIM is much more than a computerized record-keeping system. It is a MIS which provides support for the management functions associated with education in addition to assisting teachers with the requisite record keeping and clerical tasks involved when instruction is individualized. WIS-SIM is not a curricular program as are programs within computer assisted instruction (CAI). The objectives of WIS-SIM are to collect and process student information and to supply it at appropriate times and places so that it is directly applicable to instructional decision making. When the appropriate information is supplied to instructional decision makers in a usable format, efficiency and quality of decision making should increase. Teachers, students, and administrators continuously need information through which they can evaluate instructional decision making situations. The purpose of a CMI system, then, is to utilize the computer to optimize the learning environment and to maximize educational progress for each student while making efficient use of school resources, human, financial, and material.

The system is designed so that it becomes an interaction between man and machine focused on individualized instruction.

Theoretical Framework

The primary theoretical framework employed in this study is the Jungian theory of psychological types. This theory is considered appropriate and useful when interfaced with the conceptual structure of management information systems and specifically with the structure of the Wisconsin System for Instructional Management. This section will provide a description of the Jungian psychological types and demonstrate how the theory relates to users of management information systems in order to provide an overall model for the study.

Certain behavioral characteristics of the users are associated with the introduction of a decision support system such as computer managed instruction. Such behavioral characteristics may include degrees of apprehension about man-machine systems, varying levels of confidence in the system, and varying levels of perceptions of the utility of the system. Inconsistencies between the psychological types of the users presumed in the design of the system and the actual psychological types of the users in the organization may be reflected in the behavioral characteristics (Mason & Mitroff, 1973, p. 475).

Psychological Types (1923) by the Swiss psychologist, Carl G. Jung, is considered by many to be a milestone in psychological theories and Jung's crowning work. Within this work, Jung expanded his earlier psychological studies to formulations of theories regarding the individual.

Essentially Jung's theory of psychological type proposes that apparent random variations in human behavior are in fact orderly and consistent. The two general types of individuals according to his theory are "introverted" and "extraverted." The exact meanings and implications of these classifications will not be pursued in depth or detail due to their complexity and problems associated with their operationalization. It would certainly not be appropriate, however, to completely dismiss these terms.

With respect to the conscious psychology, everyone is oriented by objects or data from the outer world. Within the extraverted type, there is an outward movement of interest toward the object. The extraverted person thinks, feels, and acts as to correspond directly with objective conditions. It is the objective rather than the subjective which plays the greater role as the determining factor of the consciousness of the extravert. According to Jung, "his entire consciousness looks outwards to the world, because the important and decisive determination always comes to him from without. But it comes

to him from without, only because that is where he expects it" (Jung, 1923, p. 417).

Introversion refers to the turning inwards of the libido. The introverted type, unlike the extraverted, is governed by subjective factors. Interest does not move toward the object but recedes toward the subject, the subject being the chief factor of motivation.

Given the general classifications of introversion and extraversion, Jung's theory endeavors to explain variations in human behavior as a function of the way people prefer to use perception and judgement.

"Perception" refers in this context to the process of becoming aware of things, people, occurrences, or ideas. "Judgement" includes the processes of coming to conclusions about what has been perceived. If people differ systematically in what they perceive and the conclusions they come to, they may show corresponding differences in their reactions, values, needs, and motivations. These basic differences in perception and judgement concern the way people prefer to use their minds, thus affecting their behavior. Basic differences in perception or judgement should result in corresponding differences in behavior. Different decision making styles are certainly characterized by different individual behaviors.

According to Jung (1923), there are two contrasting methods of perception:

1. Sensation - conscious perception or sense-perception; function by which persons realize that a thing exists; reliance primarily on data received by the five senses to perceive objectives of the world; not subject to the laws of reason in that reason contrives to assimilate a great number of sensations into rational associations. A person whose whole attitude is oriented by the principle of sensation belongs to the sensation type.
2. Intuition - transmittal of perceptions in an unconscious way; perceptions accompanied by ideas or associations which the unconscious tacks onto the perceptions coming from outside; tendency to see through facts and extrapolate beyond them; ability to have hunches about things; more interest in the possibilities of things than in their present existence; overall concern with time. People whose general attitude is oriented by the principle of intuition (i.e., perception by way of the unconscious) belongs to the intuitive type.

Sensation and intuition are opposed; one who senses future possibilities through intuition is likely to be deficient in

appreciation of concrete reality as perceived through the senses (Myers, 1962, p. 52).

Jung (1923) also indicates the existence of two contrasting methods of judgement:

1. Thinking - function by which one tells what a thing is; logical process, aimed at impersonal finding(s); reliance primarily on cognitive processes; tendency toward abstract true/false judgements and formal systems of reasoning and systemization. Individuals oriented by this function are considered to be thinking types.
2. Feeling - process of appreciation, bestowing on things a personal, subjective value; reliance primarily on affective processes; evaluations tend to run along lines of good/bad, like/dislike, pleasant/unpleasant, acceptance/rejection, etc. Feeling differs from intellectual judgement in that it does not aim at establishing an intellectual connection but is solely concerned with the setting up of a subjective criterion of acceptance or rejection. When the attitude of the individual is orientated by the function of feelings, we speak of a feeling type.

Either kind of judgement can occur with either kind of perception creating four possible combinations:

Sensing plus Thinking	Thinking plus Intuition
Sensing plus Feeling	Feeling plus Intuition

It is unlikely that one would observe a "pure" type or exact fit as described by the combinations of type. Pure types are theoretical constructs only. An individual tends to exhibit a preference for one mode of perception and one mode of judgement. This does not restrict the individual from consciously or unconsciously opting for the alternative mode.

Although these modes are in conflict, neither one is superior or more fundamental than the other. All types are important in management processes and decision making. For example, strategy making is the strength of the intuitive type, while day-to-day management and decision making tends to be a forte of the sensation type (Mason & Mitroff, 1973, p. 477).

The Jungian theory, particularly as operationalized by the Myers-Briggs Type Indicator (see Chapter II) provides a framework for the orderly analysis of behavioral characteristics of management information system users. A system such as computer managed instruction processes data for the purpose of providing information for the user (e.g., teacher or administrator) to assist in certain management functions in addition to lower-

level purposes such as record keeping. Management functions may include such operations as instructional planning, grouping of students, scheduling learning activities, assessment of academic progress, analysis of programs, and coordination of activities. Implicit in this interaction between the system and user are two important components: information and decision support information. Decision support information refers to a higher level of information. An example of such data is an instructional grouping recommendation, a capability of the Wisconsin System for Instructional Management. For the purposes of the present discussion, decision-support information is information which has been treated logically and analytically in order to arrive at some conclusion. This may be presented symbolically as in Figure 10.

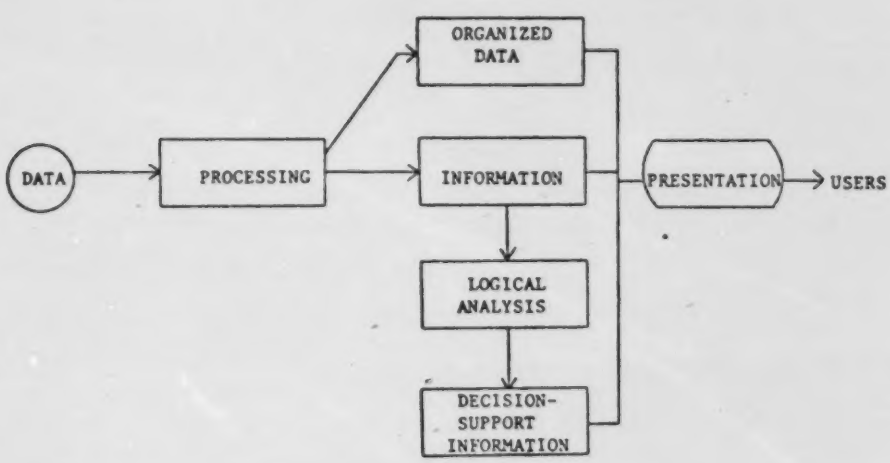

Figure 10. Information/Decision Support Information

Jungian theory suggests the possibility of problem occurrences in this schema. Each psychological type has a different concept of information provided by the system. For example, abstract symbols will constitute useful information for the pure thinking type but not for the feeling type. Sensation types speak of raw data and numbers. Information for one type will not be information for another (Mason & Mitroff, 1973, p. 478). Furthermore, analytical or logical processing of information will likely appeal to the pure thinking type but not necessarily to the feeling type.

This overall framework suggests that one might expect the system user who exhibits a sensation-thinking preference would be receptive to information provided by the system. The intuition-feeling type would appear likely to reject the information or not find it useful. The different types are likely to also exhibit different levels of confidence in the system and different levels of apprehension regarding man-machine systems.

The interface existing between the system and the users as different psychological types of the users as related to this study will be addressed in the next section.

Statement of the Problem and Hypotheses

This study is designed to investigate the relationships between the personality or psychological types of the users of a MIS and the implementation and utilization of the system within their organization. It is proposed that different psychological types are related to behavioral characteristics of the users and, in turn, to the overall success or failure of the system.

The questions of concern in this study relate specifically to the implementation and use of a management information system, WIS-SIM, in IGE elementary schools. Are behavioral characteristics of the users such as apprehension of man-machine systems, confidence in WIS-SIM, and perception of WIS-SIM's utility associated with the respective personality types? Is extent of system usage associated with psychological type? Is success or failure of the system associated with psychological types? Are there significant differences in the contribution of certain factors (e.g., psychological type, apprehension, confidence in the system, perception of utility, and perception of consultive support provided) to the overall success or failure of the system?

With regard to the above questions, the following definitions are given:

a. Man-machine system: A set of planned procedures in which man and machine capabilities are used in an integrated manner to achieve results man could not achieve without the machine. In education the results can be thought of in terms of kind of instruction and learning and amount of time required to learn (Loughary, 1966).

b. Apprehension of man-machine systems: Anxiety or fear generated by existing or contemplated man-machine systems; conceptions of dehumanization of the educational process; loss of feeling of job security and intrinsic involvement in decision making; self-estrangement and negative attitudes toward automated processes.

c. Psychological type: The classifications according to the theory of Jung and operationalized by the Myers-Briggs Type Indicator representing how one prefers to use his or her mind.

d. Confidence in WIS-SIM: User perception of system with respect to accuracy of information provided, reliability of the system, responsiveness of the system to user requirements, and correctness of information.

e. WIS-SIM usefulness: Capabilities of system with regard to assisting in diagnosing student needs, selecting

educational experiences, reporting student progress, and achieving unit goals; potential for enhancement of time usage effectiveness and reduction of clerical tasks.

These questions are presented as hypotheses and ancillary questions:

Hypotheses

Hypothesis I: There is no significant relationship between the psychological type of the WIS-SIM user and the user's apprehension of man-machine systems.

Hypothesis II: There is no significant relationship between the psychological type of the WIS-SIM user and users' confidence in WIS-SIM.

Hypothesis III: There is no significant relationship between the psychological type of the WIS-SIM user and the user's perception of WIS-SIM's usefulness as an instructional decision-support system.

Hypothesis IV: There is no significant relationship between the psychological type of the WIS-SIM user and the level of system usage.

Ancillary Questions

Question I: Is there a significant relationship between the psychological type of the WIS-SIM user in a

pilot school and the success or failure of the system in that school?

Question II: Is there a significant difference in the contribution of the following variables to the overall success or failure of the system?

a) Psychological type of user (SN, TF, JP, and EI)

b) Apprehension of user toward man-machine systems

c) Confidence of user in WIS-SIM

d) User perception of usefulness

e) Perception of adequacy of consultive support provided.

Question III: Is there a significant difference between the population distribution of psychological type among IGE elementary teachers and the population distribution of the WIS-SIM user schools?

Significance of the Study

Management information systems, as a function of the few years they have existed, particularly with computer support, have not been the subject of extensive and thorough research. A study of the user/system interaction or man-machine interface is no exception in this overall absence of research. The importance of psychological type has been almost totally

neglected within the context of MIS design (Mason & Mitroff, 1973, p. 479).

This study has potential for directing future implementations of WIS-SIM as well as enhancements in the basic system structure with regard to the interface between the system and the user. Additionally, it may provide direction in design and implementation efforts in other management information and CMI systems. Since few research efforts have been focused on the psychological dimensions of the MIS user, this study may provide a foundation for future research and development activities.

The overall CMI or MIS design and implementation process should consider the personality type of the user as well as such phenomena as varying levels of apprehension, anxiety, and confidence with respect to the system. If relationships between predictions of success and psychological variables can be established, alternative implementation designs and strategies can be planned.

Limitations of the Study

The findings of this research must be generalized cautiously to CMI and management information systems in general, since all data collected and analyzed comes from only one CMI program, WIS-SIM. A related limitation concerns the sample size. The study is limited to six schools in four school districts.

The mathematical functions generated in answer to the ancillary questions in the study are prototypic success/failure models. There obviously exist numerous variables which may or may not be included in these functions.

Chapter Summary

The purpose of this chapter is to provide the reader with an orientation to the problems and questions which will be addressed in this research. In general, this study is concerned with computer supported management information systems in education. Specifically, the study is designed to investigate the implementation and utilization of the Wisconsin System for Instructional Management, a computer managed instruction system.

A brief review of the progress in computer technology is presented in order to offer a perspective on the field. Since the 1940's the computer has evolved from a 30-ton behemoth such as ENIAC to the tiny microprocessor based on integrated circuits. This "computer on a chip" will likely change our society's total attitude toward the role of the computer. Certainly within this technological change is the utilization of computers for education.

The concept of management information systems is approached from a definitional viewpoint in addition to their role within

an organization. A suggested definition of a MIS is a set of correlated elements which serves the purpose of processing data to provide information that may assist the management functions. The MIS organizational and decision-support capabilities can range from applications at the operational level to more sophisticated applications in strategic planning.

An overview of the Wisconsin System for Instructional Management is included as this system will serve as a vehicle for the research effort. WIS-SIM is a computer-supported MIS designed to help teachers with the requisite record keeping and decision making involved when instruction is individualized. The objectives of WIS-SIM are to collect and process student information and to supply it at appropriate times so that it is directly applicable to instructional management. Utilization of the system purports to optimize the learning environment and to maximize educational progress for each student while making efficient use of school resources: human, financial, and material.

The conceptual and theoretical frameworks for this study embrace the concepts of management information systems, the Wisconsin System for Instructional Management, and the Jungian theory of psychological types. An assumption upon which the study is based proposes that users of a MIS (e.g., WIS-SIM) will exhibit certain behavioral characteristics that may be

related to their respective psychological typology. A framework which appears appropriate for the purposes of this investigation is the typology of Carl Jung. Essentially Jung's theory proposes that apparent random variations in human behavior are due to certain basic differences in the way people prefer to use perception and judgement.

The study is designed to investigate the relationships between psychological types of MIS users and the implementation and utilization of the system in their organization. These relationships raise certain questions which are presented as four hypotheses and three ancillary questions.

The significance of the study rests within its potential for directing future design and implementation efforts in the area of computer based MIS and especially computer managed instruction systems. This dimension of MIS research has been previously neglected.

A limitation of the study is the sample size. This prevents broad inferences to CMI in general as well as other systems. The prototypic success/failure prediction models are limited due to the vast number of variables that could be included in the analysis.

CHAPTER II

DESIGN AND METHODOLOGY

The purpose of this chapter is to present a description of the research design, methods of measurement, and types of analyses employed in this study. The rections included in this chapter are:

- Methodological strategy and rationale,
- Population definition and sample selection,
- Description of the participating schools,
- Instrumentation,
- Collection of data,
- Statistical treatment of data.

Methodological Strategy and Rationale

Lehmann and Mehrens (1971, p. 189) consider correlational research as being "concerned with discovering and/or measuring the degree of relationship between two or more variables." Purposes of correlational research include: making predictions, examining unknown relationships between variables in exploratory research, elimination of irrelevant variables, obtaining descriptions of phenomena, analysis of the extent of relationship between variables, and cause-effect analysis.

This study is considered correlational research as it utilizes correlational techniques to examine relationships between certain constructs identified in the conceptual framework. Additionally, background information will be presented, where applicable, from WIS-SIM project evaluation reports as well as general information about the participant WIS-SIM users. The purpose of this information is to provide the reader with a complete framework or scenario of the data from which inferences will be drawn.

Population Definition and Sample Selection

The population in this study was defined to include elementary teachers and administrators in schools which operate according to the model for Individually Guided Education (IGE). The population did not include support personnel such as counselors, librarians, teacher aides, assistants, and interns.

A subset of the population is the set of WIS-SIM users, both former and current. This set represents one of three samples which was utilized in the study. No random sampling techniques were employed in the selection of members of this sample but rather all teachers and administrators in a given school were asked to respond to the survey except those teachers or administrators who were not involved in the WIS-SIM pilot test (i.e., they were not employed by the participating schools

during the pilot test period). The schools participating in the WIS-SIM pilot tests and the pilot test periods are shown in Table 2.

TABLE 2

WIS-SIM PILOT TEST PERIODS

School	Test Period
A*	9/74 - Present
B*	12/75 - Present
C	9/74 - 6/76
D	9/75 - 6/76
E	9/75 - 6/76

* Currently using WIS-SIM

Additional information about these schools and relevant profile data will be provided in the next section of this chapter.

The number of teachers and administrators surveyed who used (and are still employed in the schools) or are currently using WIS-SIM in these schools is shown in Table 3. Two elementary schools were treated as a single unit (School A) because of their proximity and organizational structure.

TABLE 3

SAMPLE SIZES (WIS-SIM PILOT TEST SCHOOLS

School	Sample Size
A	19
B	22
C	7
D	7
E	9

A second sample included IGE teachers and administrators in schools which have not been involved with WIS-SIM or other CMI systems. This set includes approximately 50 representative members.

Description of the Participating Schools

During the WIS-SIM pilot test period (1974-76), seven schools used the system to help manage some parts of their instructional program. Profiles of these schools are given in Table 4. These data are based on the 1975-76 school year.

Several different modes of WIS-SIM operation are used in the various sites. Two elementary schools, designated as School A, operate as one large school when using CMI. These two

schools are located adjacent to each other, each with its own staff. One is a K-3 school and the other contains grades 4, 5 and 6. School A has a person employed as a CMI coordinator in addition to other responsibilities. Computer terminal operation is assigned to teacher aides. Information requests are made by teachers, processed through the coordinator and aides, and the output returned to the teachers. Curriculum support areas include reading, mathematics, and science.

TABLE 4

WIS-SIM PILOT TEST SCHOOL PROFILES

	School A	School A_2	School B	School C	School E	School D
Number of Students	379	321	650	453	540	235
Number of Teachers	12	14	28	14	21	8
Number of Aides	3	2	13	7	6	2
Number of Aides Using Computer	5	5	1	3	3	2
Number of Administrators	1	1	2	1	1	1
Programs Supported by WIS-SIM	WDRSD DMP SAPA	WDRSD DMP SAPA	WDRSD	WDRSD DMP	WDRSD	DMP

School B uses WIS-SIM in the area of reading only. The school's reading specialist assumes the responsibility for coordinating system operation and activities in the school with the assistance of a teacher aide who operates the computer terminal. The reading specialist not only coordinates WIS-SIM activities, but also acts as a major instructional decision maker in the school; in fact, few classroom teachers in School B require direct contact with WIS-SIM, since information requests, updated achievement information, and instructional diagnosis, prescription, and groupings in reading are carried out by the reading specialist.

School C terminated participation in the pilot test at the end of the first year. Most of the teachers at School C never appeared to trust the system to a point where they felt they could dispense with their manual record system; consequently, they saw the system as making more, rather than less, work for them. Additional factors leading to termination include lack of complete understanding and commitment on the part of the teachers; concurrent problems with the implementation of a new curriculum (DMP) which was to be supported by WIS-SIM; sharing a computer terminal; absence of a CMI coordinator; and inadequate consultive support (Spuck, Bozeman, & Lawrence, 1977, p. 173).

Schools D and E entered the WIS-SIM pilot test early in the 1975-76 school year. As in the case of School C, no coordinator

for CMI, other than the principal, was present in either school. In spite of some difficulties in forming an accurate student data base and the necessity for sharing a terminal for a few months, both School D and School E were successful users of the system during the 1975-76 school year.

The situation at Schools D and E changed considerably the second year. The experienced terminal operators had left, the data bases needed to be updated, a teacher strike was looming, and a date for a WIS-SIM inservice program could not be arranged. Although computer terminals and systems access were made available to the two schools during 1976-77, little or no use was made of CMI during their second pilot test year. Essentially, they were non-participants in the pilot test during that year.

Based on these descriptions, it is apparent that the modes of WIS-SIM implementation in the pilot test schools varied widely. The pilot test evaluation (Spuck, Bozeman, & Lawrence, 1977) indicates corresponding variance in the success of the system in the respective schools. This report also draws certain conclusions with regard to possible implications for successful implementation as a function of operational procedures.

Instrumentation

Four instruments were utilized in this study:

- The Myers-Briggs Type Indicator
- Confidence in WIS-SIM questionnaire
- Perception of usefulness of WIS-SIM questionnaire
- Apprehension of man-machine systems questionnaire.

The former and current users of WIS-SIM were administered the complete set of four instruments, whereas the non-CMI users were only given the Myers-Briggs Type Indicator and the questionnaire addressing apprehension of man-machine systems.

The Myers-Briggs Type Indicator is certainly the most complex instrument utilized in this study. The other three questionnaires are relatively straightforward in design. For this reason, the review of the Myers-Briggs Type Indicator and rationale for its selection is given considerable attention.

Myers-Briggs Type Indicator

The Myers-Briggs Type Indicator (MBTI) was designed explicitly to operationalize Jung's theory of type. Essentially it is a 166-item, forced choice, self report inventory for use with normal subjects. A sample of the MBTI is provided in Appendix A.

The questionnaire was developed in the early 1940's by Isabel Briggs Myers to facilitate use of Jung's theory of

psychological types. Since that time it has undergone several revisions with the current version (Form F) being released in 1962.

The MBTI contains separate indices for determining each of the four basic preferences which, under Jung's theory, structure the individual's personality (Myers, 1962, p. 1).

Index	Preference as between	Affects individual's choice as to
EI	Extraversion or Introversion	Whether to direct perception and judgement upon environment or world of ideas.
SN	Sensing or Intuition	Which of these two kinds of perception to rely on
TF	Thinking or Feeling	Which of these two kinds of judgement to rely on
JP	Judgement or Perception	Whether to use judging or perceptive attitude for dealing with environment.

The four indices (EI, SN, TF, and JP) should not be considered scales to measure traits but rather to ascertain preferences. Each index reflects a choice between opposites, analogous to right or left-handedness. Therefore, an individual is provided four letters by the MBTI indices, making up the type formula (e.g., ENFP, ISTJ, etc.). There are a total of 2^4 or 16 different combinations of type preferences.

According to Jung's theory, everyone uses all four functions (S, N, T, F), and adopts all four attitudes (E, I, J, P).

Individuals prefer one of the perceptive functions (S, N), and one of the judgement functions (T, F). These two letters appear in the middle of the type formula. The attitudes of extraversion and introversion (E, I) are independent of the SN and TF preferences and appear as the first letter of the type formula. The judgement or perception preference (J, P) is indicated by the last letter.

The constructs of judgement and perception are not explicitly defined by Jung. The existence, however, of these dimensions are implied as a part of dominant and auxiliary functions (i.e., which process is used by the individual primarily or has sovereignty).

The possible preferences and resultant type combinations are most clearly presented in figure format. Figure 11 illustrates the four preferences which are scored to arrive at an individual's type.

The 16 type combinations are provided in Figure 13. Figure 12 illustrates the location of the 16 preference types on the type table.

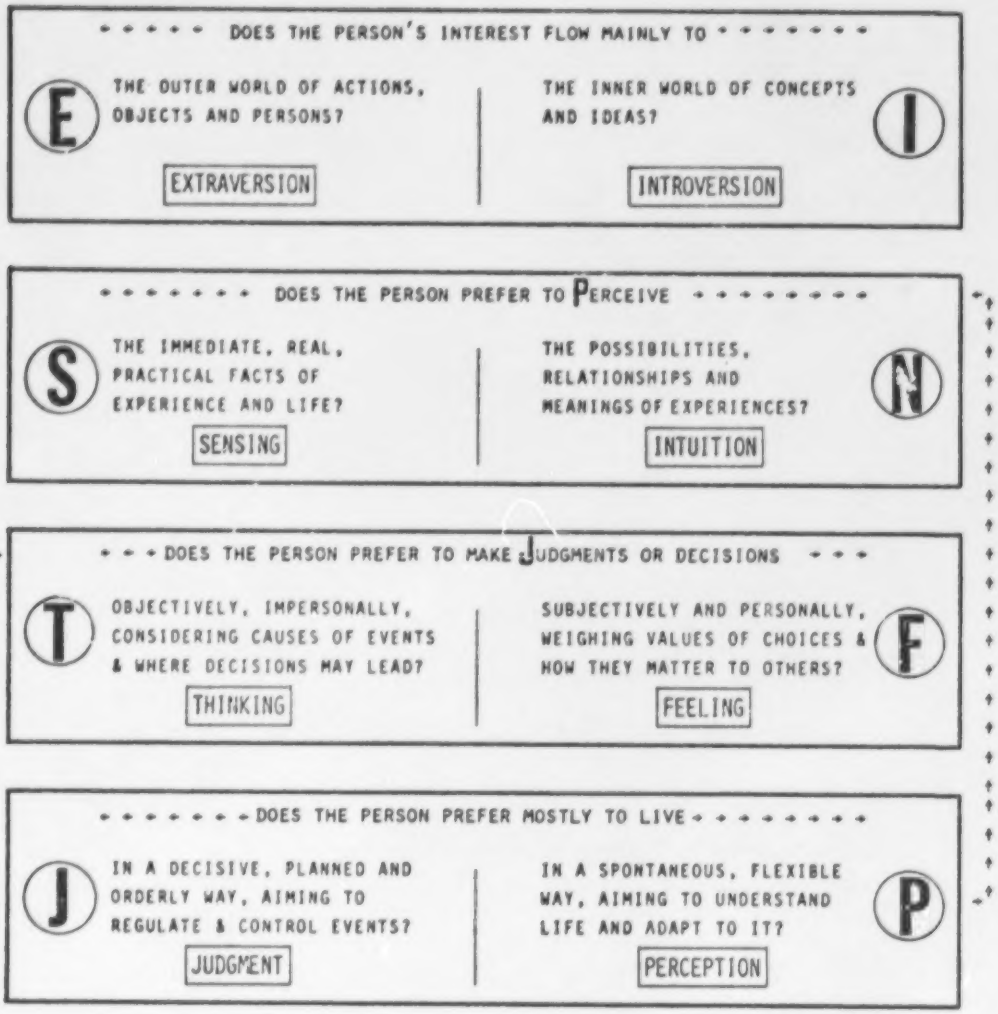
DOES THE PERSON'S INTEREST FLOW MAINLY TO
E
THE OUTER WORLD OF ACTIONS, OBJECTS AND PERSONS?
EXTRAVERSION
THE INNER WORLD OF CONCEPTS AND IDEAS?
INTROVERSION
I
DOES THE PERSON PREFER TO PERCEIVE
S
THE IMMEDIATE, REAL, PRACTICAL FACTS OF EXPERIENCE AND LIFE?
SENSING
THE POSSIBILITIES, RELATIONSHIPS AND MEANINGS OF EXPERIENCES?
INTUITION
N
DOES THE PERSON PREFER TO MAKE JUDGMENTS OR DECISIONS
T
OBJECTIVELY, IMPERSONALLY, CONSIDERING CAUSES OF EVENTS & WHERE DECISIONS MAY LEAD?
THINKING
SUBJECTIVELY AND PERSONALLY, WEIGHING VALUES OF CHOICES & HOW THEY MATTER TO OTHERS?
FEELING
F
DOES THE PERSON PREFER MOSTLY TO LIVE
J
IN A DECISIVE, PLANNED AND ORDERLY WAY, AIMING TO REGULATE & CONTROL EVENTS?
JUDGMENT
IN A SPONTANEOUS, FLEXIBLE WAY, AIMING TO UNDERSTAND LIFE AND ADAPT TO IT?
PERCEPTION
P

Figure 11. Preferences Scored by the MBTI

SOURCE: Mary H. McCaulley, Center for the Applications of Psychological Type (Gainesville, Florida).

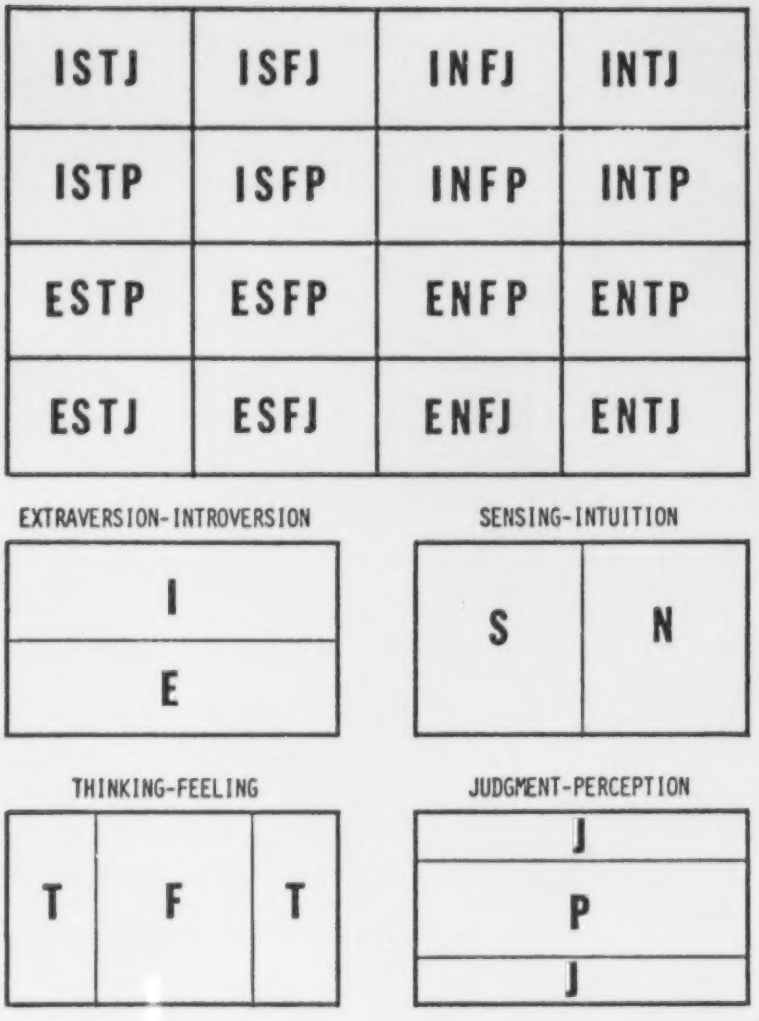

Figure 12. The Location of the 16 Preference Types on the Type Table

SOURCE: Mary A. McCaulley, Center for the Applications of Psychological Type (Gainesville, Florida).

THE THEORY: DOMINANT AND AUXILIARY FUNCTIONS FOR EACH TYPE

According to Jung's theory of psychological types, everyone uses all four *functions* (S, N, T, F), and adopts all four *attitudes* (E, I, J, P). The types are called *preference types* because people in each type *prefer* one of the two *perceptive functions* (S or N), and one of the two *judgment functions* (T or F). These preferences appear in the 2 middle letters of the type formula. Types also differ in the functions they prefer to use when in the introverted or extraverted attitudes.

The most preferred, or favorite, or *dominant function*, is extraverted in E types and introverted in I types. The second favorite or *auxiliary function* is introverted in E types and extraverted in I types. The type table below shows these relationships for each of the 16 MBTI types.

ISTJ INTROVERTED SENSING with Thinking Sensing is dominant and introverted Thinking is auxiliary and extraverted	**ISFJ** INTROVERTED SENSING with Feeling Sensing is dominant and introverted Feeling is auxiliary and extraverted	**INFJ** INTROVERTED INTUITION with Feeling Intuition is dominant and introverted Feeling is auxiliary and extraverted	**INTJ** INTROVERTED INTUITION with Thinking Intuition is dominant and introverted Thinking is auxiliary and extraverted
ISTP INTROVERTED THINKING with Sensing Thinking is dominant and introverted Sensing is auxiliary and extraverted	**ISFP** INTROVERTED FEELING with Sensing Feeling is dominant and introverted Sensing is auxiliary and extraverted	**INFP** INTROVERTED FEELING with Intuition Feeling is dominant and introverted Intuition is auxiliary and extraverted	**INTP** INTROVERTED THINKING with Intuition Thinking is dominant and introverted Intuition is auxiliary and extraverted
ESTP EXTRAVERTED SENSING with Thinking Sensing is dominant and extraverted Thinking is auxiliary and introverted	**ESFP** EXTRAVERTED SENSING with Feeling Sensing is dominant and extraverted Feeling is auxiliary and introverted	**ENFP** EXTRAVERTED INTUITION with Feeling Intuition is dominant and extraverted Feeling is auxiliary and introverted	**ENTP** EXTRAVERTED INTUITION with Thinking Intuition is dominant and extraverted Thinking is auxiliary and introverted
ESTJ EXTRAVERTED THINKING with Sensing Thinking is dominant and extraverted Sensing is auxiliary and introverted	**ESFJ** EXTRAVERTED FEELING with Sensing Feeling is dominant and extraverted Sensing is auxiliary and introverted	**ENFJ** EXTRAVERTED FEELING with Intuition Feeling is dominant and extraverted Intuition is auxiliary and introverted	**ENTJ** EXTRAVERTED THINKING with Intuition Thinking is dominant and extraverted Intuition is auxiliary and introverted

Figure 13. Dominant and Auxiliary Preferences

SOURCE: Mary H. McCaulley, Center for the Application of Psychological Type (Gainesville, Florida).

Figure 14 illustrates the four columns of the 4 x 4 matrix (Figure 13) which combine perception and judgement. The effects of the combinations of perception and judgement may be viewed in an alternate fashion as in the columns shown in Figure 14.

SENSING PLUS THINKING	SENSING PLUS FEELING	INTUITION PLUS FEELING	INTUITION PLUS THINKING
ST	**SF**	**NF**	**NT**
PRACTICAL AND MATTER-OF-FACT	SYMPATHETIC AND FRIENDLY	ENTHUSIASTIC AND INSIGHTFUL	LOGICAL AND INGENIOUS
Like using abilities in	Like using abilities in	Like using abilities in	Like using abilities in
TECHNICAL SKILLS WITH FACTS AND OBJECTS	PRACTICAL HELP AND SERVICES FOR PEOPLE	UNDERSTANDING & COMMUNICATING WITH PEOPLE	THEORETICAL AND TECHNICAL DEVELOPMENTS
for example in	for example in	for example in	for example in
Applied science Business Production Construction and many more	Patient care Community service Sales Teaching and many more	Behavioral science Research Literature & art Teaching and many more	Physical Science Research Management Forecasts & Analysis and many more

SOURCE: Mary H. McCaulley, Center for the Application of Psychological Type (Gainesville, Florida).

People who prefer:	ST SENSING + THINKING	SF SENSING + FEELING	NF INTUITION + FEELING	NT INTUITION + THINKING
focus their attention on:	Facts	Facts	Possibilities	Possibilities
and handle these with:	Impersonal analysis	Personal warmth	Personal warmth	Impersonal analysis
Thus they tend to become	Practical and matter-of-fact	Sympathetic and friendly	Enthusiastic & insightful	Logical and ingenious
and find scope for their abilities in:	Technical skills with facts and objects	Practical help and services for people	Understanding & communicating with people	Theoretical and technical developments
for example:	Applied science Business Production Construction Etc.	Patient care Community service Sales Teaching Etc.	Behavioral science Research Literature & art Teaching Etc.	Physical science Research Management Forecasts & analysis Etc.

Figure 14. Combinations of Perception and Judgement

The MBTI provides bipolar and discontinuous scales for each index with the zero point dividing where the direction of the reported preference changes. Each subject receives a four letter type formula, as discussed above, and a numerical score showing how strongly the preference is reported. The ranges of the scales are:

E53 ---------- 0 ---------- I59

S67 ---------- 0 ---------- N51

T49 ---------- 0 ---------- F51 (males)

T61 ---------- 0 ---------- F49 (females)

J55 ---------- 0 ---------- P61

Provision for converting these scales to continuous scores for statistical purposes is provided in the MBTI literature. MBTI

scores, therefore, may be treated as dichotomous or continuous data. Continuous scores are all odd numbers, ranging from 33 to 161, with 100 representing the dividing point which separates the opposite preferences.

Assessment of the Myers-Briggs Type Indicator

Several reviews of the MBTI have been conducted including Stricker and Ross (1963), Mendelsohn (1965), Sundberg (1965), Siegel (1965), Webb (1964), and Carlyn (1977).

There exists some disagreement with respect to validity of the MBTI, particularly construct validity. Construct validity refers to the extent to which a test is consistent with a given theory or to the extent it taps what is implied by the theoretical definition (Van Dalen, 1962, p. 315). Sundberg (1965, p. 148), in his review of the MBTI, concluded that there may be some uncertainty as to the extent of construct validity of the MBTI, especially with regard to the EI and JP scales. Carlyn (1977, p. 471) reported an analysis indicating that the four MBTI scales tend to have substantial loadings on different factors, lending support to Myers and Briggs' premise of a four dimensional interlocking structure of personality. The same report summarized numerous studies of construct validity and suggested that the individual scales of the MBTI measure

important dimensions of personality which seem quite similar to those postulated by Jung.

There also exist some variance in the examinations of content validity of the MBTI. Content validity concerns the extent to which the test items present a representative sample of the universe of the content that the test is designed to measure (Van Dalen, 1962, p. 313). Myers (1962) presented considerable data regarding the construction of the instrument including the nature of the items, item/index correlation, and item weighting.

Content validity of the MBTI was also examined by Bradway (1964, pp. 129-135) in a study involving 28 Jungian analysts. The analysts classified themselves according to the four types (EI, SN, TF, PJ) and these were compared with their respective typology derived from MBTI results. The results indicated the instrument is quite valid for this sample.

Mendelsohn's (1965, p. 147) analysis of the Indicator concluded that the EI scale measures extraversion-introversion in the popular senses rather than in the Jungian sense. Items of the SN scale were considered to refer to practical, conventional attitudes as opposed to idea and theory orientation. TF items were reported to reflect a legalistic, rationalistic approach versus a humanistic, sympathetic approach. JP items

seemed to refer to a preference for order and planning as opposed to spontaneity and novelty. He concluded, however, that the instrument is of "considerable potential utility... based on the findings which indicate that type scores relate meaningfully to a wide range of variables including personality, ability, interest, value, aptitude and performance measures, academic choice, and behavior ratings. Although there are better predictors available for particular tasks, few instruments appear to provide as much information as can be derived efficiently from the MBTI"(Mendelsohn, 1965, p. 147).

With regard to the reliability of the Indicator, Carlyn (1977, p. 463) reviewed the investigations of a number of researchers. Two aspects of reliability were examined in Carlyn's review: measures of internal consistency and measures of stability. The estimated reliabilities of type categories appear to be satisfactory although there is a wide range of estimates depending upon the statistical method employed. Test-retest correlations of coefficients indicate reasonably stable scores. There appears, however, need for additional long-range studies involving larger populations.

The MBTI appears to be an appropriate and acceptable instrument for operationalizing the constructs set forth in the conceptual framework of this study. Many of the questions raised regarding the instrument are certainly not without merit

and may serve to enhance future forms of the test. It appears, however, that any major concerns about the MBTI have been sufficiently addressed by the authors and reviewers.

Attitude and Perception Instrumentation

Respondents in the current and former WIS-SIM pilot test schools were given a set of questionnaires which addressed the following issues:

1. Apprehension of man-machine systems
2. Confidence in WIS-SIM
3. Perception of WIS-SIM usefulness

Copies of these questionnaires are provided in Appendix B, C & D.

These questionnaires presented questions regarding the three issues in a closed form utilizing a Likert-type scale. The scales used in the three instruments contained nine discrete items or intervals, all of which were considered equal in value loading. These items were related to degrees of agreement or disagreement with the associated question.

Items included in these questionnaires resulted from the efforts of the Computer Applications in IGE staff. Examples of items were also drawn from evaluative materials used by the project in past years.

Validity and reliability of the three instruments could not be determined prior to the initiation of the study due to the

small sample size and infeasibility of a pilot study. The reliability of the instruments is, however, addressed in Chapter III as a part of the data analysis. An item analysis of the instruments is included using a program known as LERTAP (Laboratory of Educational Research Test Analysis Package).

LERTAP uses the internal-consistency method of estimating test reliability. This method provides an indication of the extent to which each test item taps whatever the test is measuring. If each test item is considered as a sample test from the total domain, the internal consistency is roughly equivalent to the average correlation between all pairs of items (Nelson, 1974, p. 260). The approach employed for this problem is Hoyt's ANOVA for estimate of reliability. The magnitude of the reliability coefficient will be conservative as compared with other methods such as test-retest.

The standard error of measurement for each test is also provided by LERTAP. It is another means of reflecting the inaccuracy of the test, or the amount of error contained in the scores. Additional information provided in the item analysis includes the mean and standard deviation of each respective item and the product-moment correlation of the item with the test score.

Respondents from schools not utilizing computer managed instruction systems were asked to respond only to the

questionnaire addressing the issue of apprehension of man-machine systems. This portion of the survey is included in Appendix B.

Additional data obtained from each respondent includes:

1. Grade taught
2. Number of years teaching experience
3. Highest degree held
4. Age range
5. Sex

The form requesting this information sheet is provided in Appendix G.

Collection of Data

Respondents in Schools A and B were contacted through their respective CMI coordinators after the investigator obtained permission from the building principal. These coordinators continued to serve as liasons throughout the distribution and return of the survey instruments.

The respondents in School C were contacted through the district's science coordinator. This procedure was used because of possible reluctance on the part of the teachers to participate in the study. The science coordinator, a former CMI project staff member, had a better rapport with the teachers than did R & D Center staff and was able to facilitate data collection.

Data collection from Schools D and E was handled through the principals of the respective schools. Some initial difficulties were encountered in the form of teacher reluctance to respond to the survey. In order to obtain their cooperation, some pressure had to be exerted by the superintendent. This recourse raises some concern with regard to accuracy and content.

Respondents in non-CMI schools were secured through the cooperation of the Colorado Department of Public Instruction and personnel in the Wisconsin R & D Center. The objective in the collection of this set of respondents was to obtain a representative sample.

Statistical Treatment of the Data

The data collected in this study are analyzed and presented in a format which attempts to fulfill the following purposes:

1. To present a profile of the schools surveyed with respect to psychological types, attitudes measured, and staff demographic information.
2. To test the hypotheses stated in Chapter I.
3. To address the ancillary questions stated in Chapter I.

This format is considered appropriate in order to obtain some intuitive feeling about the nature of respective schools, in addition to a quantitative approach to problems and issues to be discussed.

General Data Analysis

For each respondent participating in the study, the following data were available:

- Mean score on the questionnaire related to apprehension of man-machine systems.
- Mean score on the questionnaire related to confidence in WIS-SIM.
- Mean score on the questionnaire related to perception of WIS-SIM's usefulness as a decision-support system.

These scores are reported on an interval from 1-9, where 1 represents a negative attitude toward the construct and 9 represents a favorable attitude.

The psychological type of each respondent was also obtained. These types are reported as four continuous scales from 33 to 161 (see page 69) for each of the four indices (E/I, S/N, T/F, J/P).

A compilation of the total data collected is presented in Chapter III including general profiles of sample population. This includes tables illustrating mean scores and standard deviations on the three questionnaires and distributions of psychological types in each school surveyed as well as staff demographic data.

The following narrative addresses the specific statistical techniques to be employed in the testing of hypotheses.

Statistical Tests of the Hypotheses

A phenomenon derived from the study of the psychological types and the review of management information system theory is the relationship between the user (classified as a psychological type) and the user's attitudes toward information, decision-support systems, and man-machine systems. These relationships, set forth explicitly in Chapter I, are restated here:

Hypothesis I: There is no significant relationship between the psychological type of the WIS-SIM user and the user's apprehension of man-machine systems.

Hypothesis II: There is no significant relationship between the psychological type of the WIS-SIM user and the user's confidence in WIS-SIM.

Hypothesis III: There is no significant relationship between the psychological type of the WIS-SIM user and the user's perception of WIS-SIM's usefulness as an instructional decision-support system.

The primary statistical procedure employed in the analysis of Hypotheses I, II, and III was that of multiple regression. This procedure permitted the respective dependent variables (apprehension of man-machine systems, confidence in WIS-SIM, and perception of WIS-SIM usefulness) to be regressed on the four independent or predictor variables (E/I, S/N, T/F, J/P type

indices). A regression equation of the form

$$\hat{Y}=b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + C$$

was derived where b_1, b_2, b_3, and b_4 are regression coefficients that will minimize the differences between the actual values of Y (the dependent variable) and the estimates Y. A similar equation was calculated which includes only the S/N and T/F type independent variables as these appear to be the variables most valuable within the Jungian framework.

In addition to the multiple regression procedure, stepwise multiple regression was employed. In this method, a series of regression models was tried, each model consisting of a different set of independent variables.

In both the multiple regression and the stepwise multiple regression, the means, standard deviations, and correlations of all the variables are reported. The summary of the regression results included:

1. Multiple correlation coefficient (R) - correlation between actual and predicted scores.
2. Coefficient of determination (R^2) - proportion of variance in the dependent variable accounted for by the set of independent variables.
3. Regression coefficients for the model (b_i).
4. Significance of the weights for the final model.

The R and R^2 increase for each step were also included in the results.

Treatment of Ancillary Questions

In addition to the three hypotheses stated in Chapter I, three ancillary questions were raised.

Question I: Is there a significant relationship between the psychological type of the WIS-SIM user in a pilot school and the success or failure of the system in that school?

Question II: Is there a significant difference in the contribution of the following variables to the overall success or failure of the system?

Question III: Is there a significant difference between the population distribution of psychological type among IGE elementary teachers and the population distribution derived from the WIS-SIM user schools?

In order to address Question I, a discriminant function analysis was employed to test the difference in mean psychological types of users in the schools classified as successful and unsuccessful. Successful and unsuccessful users were defined as users who elected or declined to continue participation in the WIS-SIM project. The psychological type indices used in the compilation of the mean were the S/N and T/F. Schools

classified as successful were School A and School B. Those classified as unsuccessful were Schools C, D, and E.

Ancillary Question II is, in addition to being a classification problem, a question regarding the determination of which of eight variables are important in the classification of a school as successful or unsuccessful (success, again, being defined as continuing usage of WIS-SIM). The statistical method employed was two-way discriminant analysis. This technique allows the combining of measurements with weights chosen in such a way that the differences between groups are maximized (Sanathanan, 1975, p. 239). This weighted combination is referred to as the discriminant function.

Ancillary Question III was analyzed by use of a Chi Square test to determine if the frequency of psychological types in the participant CMI schools deviate significantly from the frequencies obtained from the sample of non-CMI IGE schools. Tables and tests of significant differences are presented.

Chapter Summary

The purpose of this chapter was to present a description of the research design employed in the study, methods of measurement, and types of analysis used. This is considered necessary in order to provide a transition from Chapter I which concerns

problem orientation to Chapter III which includes the analysis of data.

This study is considered correlational research as it addresses such purposes as the examination of the relationship between variables, description of phenomena, and making predictions. In addition to correlational techniques employed, background information was employed to provide a complete framework for this overall study.

The population of the research was the set of IGE elementary teachers and administrators. Of particular interest are the IGE teachers and administrators who have participated in the WIS-SIM pilot tests. Descriptions of the participating schools were presented in order to generate a profile of the sample.

Instruments utilized in the study included the Myers-Briggs Type Indicator and three questionnaires designed to measure confidence in WIS-SIM, perception of usefulness of WIS-SIM, and apprehension of man-machine systems. Descriptions of these instruments were presented along with reliability and validity information.

A brief discussion of the techniques to be employed in the data analysis was included to provide the logical transition to Chapter III. Essentially, analysis was performed using

multiple regression, stepwise regression, discriminate analysis, Chi-Square tests, and analysis of variance.

CHAPTER III

PRESENTATION AND ANALYSIS OF DATA

This chapter presents the analysis of data collected in an effort to address the hypotheses and questions presented in Chapter I. The chapter contains five sections as follows:

- Reliability and validity of perception and attitude instruments
- Analysis of perception and attitude data
- Profiles of respondents
- Analysis of relationships between variables (Hypotheses I-IV)
- Discussion of ancillary questions.

With regard to analysis of the data associated with the hypotheses and ancillary questions, only immediate conclusions and inferences of a statistical nature are presented. A more extensive examination of the results of the analyses is presented in Chapter IV as part of the overall conclusions and implications of the study.

Reliability and Validity of Perception and Attitude Instruments

As indicated in Chapter II, a pilot test of this study was not feasible. Consequently, reliability data relative to the three instruments designed to measure confidence in WIS-SIM, perception of the usefulness of WIS-SIM, and apprehension of man-machine systems were not available prior to the initiation of the study. For this reason, tests of reliability of these instruments were included as a part of the analysis of data.

Reliability of an instrument refers to the consistency of scores or stability of measurement when the same individuals are re-examined with the same test or with different sets of equivalent items on different occasions (Anastasi, 1968, p. 71). There are generally considered to be three methods of determining the reliability of an instrument:

1. Test-retest reliability--The identical test is repeated on a different occasion. The reliability coefficient is the correlation between the scores obtained by the same persons on the two different administrations.
2. Parallel forms reliability--Two forms of the same instrument are administered to a representative same of subjects. Scores are correlated to obtain a reliability coefficient.

3. Internal consistency reliability--This method estimates the extent to which each test item measures a given construct. Procedures for determining these estimates include split-half reliability, Kuder-Richardson formulas, Hoyt's ANOVA, and Cronbach's coefficient alpha.

The test-retest method for determining an estimate of reliability of the three instruments was considered inappropriate due to the direct relationship between the attitudes and perceptions being measured and the immediate performance of the CMI system. For example, if the system was providing immediate and accurate information to users in a given week, it was likely that their measured attitudes and perceptions would have been quite different from those obtained during a week in which there existed technical problems, slow turn-around, and malfunctions. The receptivity to a second instrument by the participants in the study would also have likely been negative, having possible effects on apparent stability which would not have been attributable to the instruments.

The parallel forms method was not feasible because of the unavailability of two representative forms of the three instruments. The user attitudes as a function of system performance at a given time also would have confounded this approach, as with the test-retest method.

The procedure utilized in this study for obtaining an estimate of the reliability of the three instruments was the internal consistency method. Estimates of internal consistency were obtained by Hoyt's ANOVA using the computer program LERTAP. With the exception of providing for differential weighting of test items, which is permitted by Hoyt's ANOVA, the technique is algebraically equivalent to the Kuder-Richardson formula 20 (Nelson, 1974, p. 260). This can be shown mathematically to be the mean of all split-half reliability coefficients resulting from different splittings of a test (Anastasi, 1968, p. 85).

Table 5 presents a description of the three instruments employed in the study. Table 6 provides the results of the reliability measures obtained from the LERTAP analysis of the three instruments.

TABLE 5

DESCRIPTION OF ATTITUDE AND PERCEPTION INSTRUMENTS

Instrument	Title	Number of Items	Alternatives	Weight	Maximum Possible Score
1	Confidence in WIS-SIM	6	1-9	1.0	54
2	Perception of WIS-SIM Usefulness	10	1-9	1.0	90
3	Apprehension of Man-Machine Systems	6	1-9	1.0	54

TABLE 6

RELIABILITY OF ATTITUDE AND PERCEPTION INSTRUMENTS

Instrument	Title	Hoyt Estimate of Reliability	Standard Error of Measurement
1	Confidence in WIS-SIM	.89	3.27
2	Perception of WIS-SIM Usefulness	.95	4.50
3	Apprehension of Man-Machine Systems	.61	4.48

(N=61)

The validity of an instrument or a measure is how well it fulfills the function for which it is being used (Stanley & Hopkins, 1972, p. 101). Stated another way, validity addresses the question of what constructs the instrument purports to measure and how well it does so. There are generally considered to be three principal categories of validity:

1. Content validity - This aspect of validity involves how well the content of the instrument samples the behavioral domain purportedly addressed.
2. Criterion-related validity - This addresses the issue of how well the instrument compares with other measures of the construct which the test is designed to indicate (i.e., a direct and independent measurement).

3. Construct validity - This category refers to the extent to which the instrument measures the theoretical construct purportedly addressed.

The issue of content validity was addressed from the outset of the instrument construction. The group involved in preparation of items were members of the WIS-SIM staff and persons familiar with the project. Once the content area was defined by the group, sample items were generated and refined through group review and discussion. Sample items also were obtained from previous questionnaires used in the WIS-SIM evaluation.

This group considered the content of the instruments to comprise a definition of the constructs measured. In addition to this evaluation, several staff members of WIS-SIM pilot test schools were asked to review the questionnaires. They agreed with the opinion of the design group.

An evaluation of the instruments with respect to criterion-related validity was not possible as there are no known instruments designed to measure the given constructs.

Only a subjective judgement could be made regarding the construct validity of the instruments. A review of the instruments was made person-by-person and school-by-school to compare the quantitative measures reported against known perceptions and attitudes in the school. The scores appeared to substantiate these known attitudes and perceptions.

Within the context of this discussion, only one of the three instruments raised any particular concern with regard to reliability and validity. The measure of apprehension of man-machine systems (instrument 3) had an estimate of reliability of .61. (Testing literature indicates a coefficient of .70 or higher as a general level of adequate reliability for an instrument of this nature.)

A LERTAP item analysis of the six items included in instrument 3 revealed low subtest correlations for items 5 and 6. This suggested the possibility of the existence of two more dimensions within the instrument. A factor analysis was conducted on the six items using the program FACTOR3 (STATJOB Series). A principal components analysis indicated two components. The ranks of loading after rotation were determined as shown in Table 7.

Re-examination of the content of items 1, 2, and 4, the three highest ranked items in component 1, revealed the statements to address computer applications specifically to education. This may explain the resultant loading. Reliability was again tested with respect to internal consistency using only items 1, 2, and 4. The Hoyt estimate of reliability based on these three items increased to .72.

TABLE 7

RANKS OF LOADING OF MAN-MACHINE SYSTEMS QUESTIONNAIRE ITEMS

Item	Ranks	
	Component 1	Component 2
1	3	3
2	2	
3	4	
4	1	
5		1
6	5	2

Recommendations for addressing this concern as well as the construction of future addressing man-machine systems attitude questionnaires are included in Chapter IV.

Analysis of Perception and Attitude Instruments

Respondents from the five WIS-SIM pilot test schools were asked to respond to three questionnaires measuring the following constructs:

- Apprehension of man-machine systems
- Confidence in WIS-SIM
- Usefulness of WIS-SIM

A general analysis of the data obtained from these instruments provided insight into the atmosphere toward computer support of instructional decision making in the pilot schools. The results of these questionnaires for the respective schools are presented in Tables 8-10. As previously indicated, 9.0 was the highest and most positive score obtainable and 1.0 was the lowest and most negative score in each case.

TABLE 8

APPREHENSION OF MAN-MACHINE SYSTEMS

School	Number of Respondents	Mean	Standard Deviation
A	19	5.91	1.34
B	19	5.17	1.40
C	7	5.14	1.02
D	7	5.67	1.08
E	9	5.89	1.53
All Schools	61	5.65	1.29

TABLE 9

CONFIDENCE IN WIS-SIM

School	Number of Respondents	Mean	Standard Deviation
A	19	6.20	1.64
B	19	3.79	1.61
C	7	3.24	1.25
D	7	3.69	.27
E	9	3.96	2.12
All Schools	61	4.62	2.05

The School A respondents consistently showed a higher perception of usefulness of the WIS-SIM and greater confidence in WIS-SIM. These results were anticipated as School A was, by far, the largest user of the system. A comparison of the scores on these two questionnaires with previous evaluation data indicated stability in these two areas.

The instrument measuring apprehension of man-machine systems produced scores which were somewhat unexpected. The experience of the project staff with the users in the five

TABLE 10

USEFULNESS OF WIS-SIM

School	Number of Respondents	Mean	Standard Deviation
A	19	6.20	1.64
B	19	3.79	1.61
C	7	3.24	1.25
D	7	3.69	.27
E	9	3.96	2.12
All Schools	61	4.62	2.05

schools suggested that the personnel in School A would have been more positive in their attitudes toward man-machine systems than the other schools. This represented somewhat of a paradox. Unfortunately this question could not be resolved due to the standard error of measurement of this instrument (.747) being almost equal to the range of the mean of the scores on this instrument for the respective schools.

If, in fact, the data do present an accurate representation of attitudes, this could be explained by several factors.

Although two schools may have similar attitudes toward man-machine systems, the mode of implementation of WIS-SIM, technical problems (as were encountered at the School D and School E test sites), and organizational structure may certainly have a great impact on a school's perceptions of system usefulness. Therefore, it may not be logical to conclude that if one possesses a positive attitude toward man-machine systems (i.e., low level of apprehension) that a corresponding perception of system usefulness or confidence may be expected.

Profiles of Respondents

Two categories of information were collected from each participant in the study and are presented in the profiles of respondents:

- General demographic data - This includes sex, age range, number of years teaching experience, and highest academic degree held.
- Psychological type - The distribution of the 16 Jungian type classifications are presented for each school.

Information in the first category is provided in Table 11 below.

TABLE 11

PROFILE OF RESPONDENTS (WIS-SIM PILOT TEST SCHOOLS)

Name of School	Total No. of Respondends	Sex		Age Range			Number of Years* Teaching Exper.				Highest Degree Held	
		Number Males	Number Females	20-26	27-34	35--	0-5	6-10	11-15	16--	BA/BS	MA/MS
A	19	1	18	2	5	12	6	4	0	6	12	7
B	19	4	15	1	14	4	3	6	3	7	13	6
C	7	1	6	1	4	2	1	4	0	2	6	1
D	7	1	6	2	2	3	4	2	0	0	6	1
E	9	1	8	2	3	4	3	2	4	0	6	3

*This figure may not equal the total due to incomplete surveys.

Tables 12-16 present the psychological type distribution of respondents in each of the WIS-SIM pilot test schools and the totals for all schools. The distribution data include number of persons and percent in each of the 16 type categories. Additionally, the number and percent in the sub-classification are included.

Analysis of Relationships Between Variables

A principal concern of this research is the analysis of the relationships between certain constructs, defined as dependent variables, operating as a function of a user's psychological type, defined as an independent variable. This section explores these relationships as set forth explicitly in Hypotheses I-IV. The essential procedure utilized is multiple linear regression analysis. Each of the four hypotheses is analyzed individually in the following sections.

Apprehension of Man-Machine Systems as a Function of Psychological Type. Hypothesis I addresses the relationship between these constructs and is stated as follows:

> There is no significant relationship between the psychological type of the WIS-SIM user and the user's apprehension of man-machine systems.

TABLE 12

PSYCHOLOGICAL TYPE DISTRIBUTION

(SCHOOL A)

SENSING TYPES WITH THINKING	SENSING TYPES WITH FEELING	INTUITIVE TYPES WITH FEELING	INTUITIVE TYPES WITH THINKING			N	%
					E	15	78.95
I S T J	I S F J	I N F J	I N T J	J	I	4	21.05
				U			
				D	S	11	57.89
N= 0	N= 3	N= 0	N= 0	G	N	8	42.11
				I			
%= .00	%=15.79	%= .00	%= .00	N I	T	4	21.05
				G N	F	15	78.95
				T			
				R	J	16	84.21
				O	P	3	15.79
I S T P	I S F P	I N F P	I N T P	V			
				E	IJ	3	15.79
				R	IP	1	5.26
N= 0	N= 0	N= 1	N= 0	T			
				S	EP	2	10.53
%= .00	%= .00	%= 5.26	%= .00	P	EJ	13	68.42
				E			
				R	ST	2	10.53
				C	SF	9	47.37
				E			
E S T P	E S F P	E N F P	E N T P	P	NF	6	31.58
				T	NT	2	10.53
				I			
N= 0	N= 1	N= 1	N= 0	V	SJ	10	52.63
				E	SP	1	5.26
%= .00	%= 5.26	%= 5.26	%= .00	S E			
				X	NP	2	10.53
				T	NJ	6	31.58
				R			
				A	TJ	4	21.05
E S T J	E S F J	E N F J	E N T J	J V	TP	0	.00
				U E			
				D R	FP	3	15.79
N= 2	N= 5	N= 4	N= 2	G T	FJ	12	63.16
				I S			
%=10.53	%=26.32	%=21.05	%=10.53	N	IN	1	5.26
				G	EN	7	36.84
					IS	3	15.79
					ES	8	42.11

TABLE 13

PSYCHOLOGICAL TYPE DISTRIBUTION

(SCHOOL B)

SENSING TYPES WITH THINKING	SENSING TYPES WITH FEELING	INTUITIVE TYPES WITH FEELING	INTUITIVE TYPES WITH THINKING			N	%
					E	10	52.63
I S T J	I S F J	I N F J	I N T J	J	I	9	47.37
				U			
				D	S	12	63.16
N= 3	N= 3	N= 0	N= 0	G	N	7	36.84
				I			
%=15.79	%=15.79	%= .00	%= .00	N I	T	9	47.37
				G N	F	10	52.63
				T			
				R	J	12	63.16
				O	P	7	36.84
I S T P	I S F P	I N F P	I N T P	V			
				E	IJ	6	31.58
				R	IP	3	15.79
N= 2	N= 0	N= 0	N= 1	T			
				S	EP	4	21.05
%=10.53	%= .00	%= .00	%= 5.26	P	EJ	6	31.58
				E			
				R	ST	8	42.11
				C	SF	4	21.05
				E			
E S T P	E S F P	E N F P	E N T P	P	NF	6	31.58
				T	NT	1	5.26
				I			
N= 1	N= 0	N= 3	N= 0	V	SJ	9	47.37
				E	SP	3	15.79
%= 5.26	%= .00	%=15.79	%= .00	S E			
				X	NP	4	21.05
				T	NJ	3	15.79
				R			
				A	TJ	5	26.32
E S T J	E S F J	E N F J	E N T J	J V	TP	4	21.05
				U E			
				D R	FP	3	15.79
N= 2	N= 1	N= 3	N= 0	O T	FJ	7	36.84
				I S			
%=10.53	%= 5.26	%=15.79	%= .00	N	IN	1	5.26
				G	EN	6	31.58
					IS	8	42.11
					ES	4	21.05

TABLE 14

PSYCHOLOGICAL TYPE DISTRIBUTION

(SCHOOL C)

SENSING TYPES WITH THINKING	SENSING TYPES WITH FEELING	INTUITIVE TYPES WITH FEELING	INTUITIVE TYPES WITH THINKING			N	%
					E	2	40.00
I S T J	I S F J	I N F J	I N T J	J	I	3	60.00
				U			
				D	S	2	40.00
N= 0	N= 1	N= 0	N= 1	G	N	3	60.00
				I			
%= .00	%=20.00	%= .00	%=20.00	N I	T	2	40.00
				G N	F	3	60.00
				T			
				R	J	4	80.00
				O	P	1	20.00
I S T P	I S F P	I N F P	I N T P	V			
				E	IJ	2	40.00
				R	IP	1	20.00
N= 0	N= 1	N= 0	N= 0	T			
				S	EP	0	.00
%= .00	%=20.00	%= .00	%= .00	P	EJ	2	40.00
				E			
				R	ST	0	.00
				C	SF	2	40.00
				E			
E S T P	E S F P	E N F P	E N T P	P	NF	1	20.00
				T	NT	2	40.00
				I			
N= 0	N= 0	N= 0	N= 0	V	SJ	1	20.00
				E	SP	1	20.00
%= .00	%= .00	%= .00	%= .00	S E			
				X	NP	0	.00
				T	NJ	3	60.00
				R			
				A	TJ	2	40.00
E S T J	E S F J	E N F J	E N T J	J V	TP	0	.00
				U E			
				D R	FP	1	20.00
N= 0	N= 0	N= 1	N= 1	G T	FJ	2	40.00
				I S			
%= .00	%= .00	%=20.00	%=20.00	N	IN	1	20.00
				G	EN	2	40.00
					IS	2	40.00
					ES	0	.00

TABLE 15

PSYCHOLOGICAL TYPE DISTRIBUTION

(SCHOOLS D AND E)

SENSING TYPES WITH THINKING	SENSING TYPES WITH FEELING	INTUITIVE TYPES WITH FEELING	INTUITIVE TYPES WITH THINKING			N	%
					E	9	56.25
I S T J	I S F J	I N F J	I N T J	J	I	7	43.75
				U			
				D	S	8	50.00
N= 1	N= 1	N= 3	N= 0	G	N	8	50.00
				I			
%= 6.25	%= 6.25	%=18.75	%= .00	N I	T	1	6.25
				G N	F	15	93.75
				T			
				R	J	10	62.50
				O	P	6	37.50
I S T P	I S F P	I N F P	I N T P	V			
				E	IJ	5	31.25
				R	IP	2	12.50
N= 0	N= 2	N= 0	N= 0	T			
				S	EP	4	25.00
%= .00	%=12.50	%= .00	%= .00	P	EJ	5	31.25
				E			
				R	ST	1	6.25
				C	SF	7	43.75
				E			
E S T P	E S F P	E N F P	E N T P	P	NF	8	50.00
				T	NT	0	.00
				I			
N= 0	N= 1	N= 3	N= 0	V	SJ	5	31.25
				E	SP	3	18.75
%= .00	%= 6.25	%=18.75	%= .00	S E			
				X	NP	3	18.75
				T	NJ	5	31.25
				R			
				A	TJ	1	6.25
E S T J	E S F J	E N F J	E N T J	J V	TP	0	.00
				U E			
				D R	FP	6	37.50
N= 0	N= 3	N= 2	N= 0	G T	FJ	9	56.25
				I S			
%= .00	%=18.75	%=12.50	%= .00	N	IP	3	18.75
				G	IJ	5	31.25
					IS	4	25.00
					FS	4	25.00

TABLE 16

PSYCHOLOGICAL TYPE DISTRIBUTION

(ALL WIS-SIM PILOT TEST SCHOOLS)

SENSING TYPES WITH THINKING	SENSING TYPES WITH FEELING	INTUITIVE TYPES WITH FEELING	INTUITIVE TYPES WITH THINKING				N	%
						E	36	62.07
I S T J	I S F J	I N F J	I N T J	J		I	22	37.93
				U				
				D		S	32	55.17
N= 4	N= 8	N= 3	N= 1	G		N	26	44.83
				I				
%= 6.90	%=13.79	%= 5.17	%= 1.72	N	I	T	15	25.86
				G	N	F	43	74.14
					T			
					R	J	42	72.41
					O	P	16	27.59
I S T P	I S F P	I N F P	I N T P		V			
					E	IJ	16	27.59
					R	IP	6	10.34
N= 1	N= 3	N= 1	N= 1		T			
					S	EP	10	17.24
%= 1.72	%= 5.17	%= 1.72	%= 1.72	P		EJ	26	44.83
				E				
				R		ST	10	17.24
				C		SF	22	37.93
				E				
E S T P	E S F P	E N F P	E N T P	P		NF	21	36.21
				T		NT	5	8.62
				I				
N= 1	N= 2	N= 7	N= 0	V		SJ	25	43.10
				E		SP	7	12.07
%= 1.72	%= 3.45	%=12.07	%= .00	S	E			
					X	NP	9	15.52
					T	NJ	17	29.31
					R			
					A	TJ	12	20.69
E S T J	E S F J	E N F J	E N T J	J	V	TP	3	5.17
				U	E			
				D	R	FP	13	22.41
N= 4	N= 9	N= 10	N= 3	G	T	FJ	30	51.72
				I	S			
%= 6.90	%=15.52	%=17.24	%= 5.17	N		IN	6	10.34
				G		EN	20	34.48
						IS	16	27.59
						ES	16	27.59

The test of this hypothesis included the use of the product moment correlation matrix derived from the observed measure of the respondents' apprehension of man-machine systems and their respective psychological type indices (E/I, S/N, T/F, and J/P). Linear regression statistics reported include the following:

- Regression coefficients
- Partial F value (testing the hypothesis that the regression parameter is equal to zero)
- Significance level of the partial F value
- Multiple correlation coefficient (correlation of the actual measures and the predicted measures)
- Coefficient of determination (amount of the total variation of the dependent variable explained by all the independent variables in the regression equation)
- F-test for regression (the test of the null hypothesis $H_0: B_1=B_2=B_3=B_4=0$)
- Significance level of the regression

A stepwise multiple regression procedure was employed using STEPREG1 (STATJOB Series). Although several linear regression models were generated in each case, only the final model including all variables was reported. Because of wide variance in the responses obtained from the sites included in the sample, several groupings of data were employed to assist in analyses.

The first model was based upon data obtained from respondents in all the WIS-SIM pilot test schools (Schools A-E).

TABLE 17

CORRELATION MATRIX OF APPREHENSION OF MAN-MACHINE SYSTEMS VS. PSYCHOLOGICAL TYPE (SCHOOLS A-E)

Variable Name	Apprehension in Man-Machine Systems	E/I	S/N	T/F	J/P
1. Apprehension of Man-Machine Systems	1.000				
2. E/I	-.057	1.000			
3. S/N	.113	-.459	1.000		
4. T/F	-.087	-.229	.025	1.000	
5. J/P	.107	-.145	.440	.251	1.000

It was readily perceived from the information in Tables 17 and 18 that no apparent relationship existed between the variables of interest. In order to account for the fact that various data sources may have a deterministic effect on the responses, dummy blocking variables were introduced into this data set. This produced negligible effects, raising R from .172 to only .281 and R^2 from .03 to .08.

The linear regression equation based on these data is:

$$\hat{y} = 6.013 - .002X_1 + .002X_2 - .007X_3 + .006X_4$$

TABLE 18

BASIC REGRESSION STATISTICS/APPREHENSION OF MAN-MACHINE SYSTEMS VS. PSYCHOLOGICAL TYPE (SCHOOLS A-E)

Variable Name	Type	Regression Coefficient	Partial F	Significance Level
1. Apprehension of Man-Machine Systems	Dependent	---	---	---
	Constant	6.013	13.261	.0006
2. E/I	Independent	-.002	.097	.757
3. S/N	Independent	.002	.074	.786
4. T/F	Independent	-.007	.741	.393
5. J/P	Independent	.006	.436	.512

Multiple Correlation Coefficient (R)	.172
Coefficient of Determination (R^2)	.030
F-Ratio (d.f.=4.53)	.40
Significance Level	.805

A similar analysis was performed on the School A data. The results are presented in Tables 19 and 20.

The linear regression equation based on these data is:

$$\hat{y} = 8.161 - .018X_1 + .011X_2 - .005X_3 - .011X_4$$

As indicated in Table 19, a significant correlation existed in this group between the E/I and S/N type indices and the measure of apprehension of man-machine systems. The

TABLE 19

CORRELATION MATRIX OF APPREHENSION OF MAN-MACHINE SYSTEMS VS. PSYCHOLOGICAL TYPE (SCHOOL A)

Variable Name	Apprehension of Man-Machine Systems	E/I	S/N	T/F	J/P
1. Apprehension of Man-Machine Systems	1.000				
2. E/I	-.494**	1.000			
3. S/N	.419*	-.505	1.000		
4. T/F	-.368	.379	-.398	1.000	
5. J/P	-.111	.098	.366	.206	1.000

* Significant beyond .1 level

** Significant beyond .05 level

direction indicated that introverts and intuition types are more apprehensive than those respondents who were extraverts and sensation types.

A similar analysis based only the School B data produced no significant correlations or linear regression equations. The School C, D and E combined data indicated a correlation of .459 between the J/P index and apprehension of man-machine systems. This correlation was significant beyond the .05 level

TABLE 20

BASIC REGRESSION STATISTICS/APPREHENSION OF MAN-MACHINE SYSTEMS VS. PSYCHOLOGICAL TYPE (SCHOOL A)

Variable Name	Type	Regression Coefficient	Partial F	Significance Level
1. Apprenension of Man-Machine Systems	Dependent	---	---	---
	Constant	8.161	10.295	.006
2. E/I	Independent	-.018	1.117	.308
3. S/N	Independent	.011	.840	.375
4. T/F	Independent	-.006	.169	.688
5. J/P	Independent	-.011	.380	.548

Multiple Correlation Coefficient (R) .569

Coefficient of Determination (R^2) .323

F-Ratio (d.f.=4,14) 1.67

Significance Ratio 2.12

and denoted individuals with a preference for perception exhibit apprehension of man-machine systems.

As discussed earlier in this chapter, some concern existed regarding the reliability and validity of the instrument measuring the construct "apprehension of man-machine systems." A Hoyt

estimate of reliability of .61 was reported (items 1-6). This was raised to .72 by using only items 1, 2, and 4 as suggested by factor analysis.

A linear regression analysis was performed using only the measure obtained from items 1, 2, and 4. This produced only minor changes in the results obtained from the complete instrument. No significant correlations or significant linear regression equations were produced.

Based on the information obtained in this analysis of data related to Hypothesis I, the following conclusions were drawn:

- Based on the complete data set (i.e., the sample of respondents from WIS-SIM pilot test schools) there did not exist a significant linear relationship between the user's psychological type and the user's apprehension of man-machine systems. Additional analysis of the data indicated a higher order relationship was also non-existent. Therefore, Hypothesis I was not rejected.
- The data obtained from the School A suggested that a relationship did exist between E/I and apprehension and S/N and apprehension. These correlations were significant beyond the .10 and .05 respectively. The direction of both correlations were consistent with the theoretical

framework. The School C, D, and E data also indicated a significant correlation between J/P and apprehension. The theoretical framework did not suggest a clear direction which should have been expected between these variables.

Confidence in WIS-SIM as a Function of Psychological Type. Hypothesis II concerns the relationship between these constructs and is stated as follows:

> There is no significant relationship between the psychological type of the WIS-SIM user and the user's confidence in WIS-SIM.

The test of this hypothesis included the use of correlations between the observed measure of confidence of WIS-SIM and the four psychological type indices (E/I, S/N, T/F, and J/P) for the respondents included in the sample derived from WIS-SIM pilot test schools. These data were also used to generate linear regression equations describing the measures. In each case, confidence in WIS-SIM was treated as the dependent variable and the four type indices as independent variables. Although several models were generated with a stepwise multiple regression procedure using the STEPREG program, only the final model including all variables is presented. The first regression analysis presented used the data from all WIS-SIM pilot test schools (Schools A-E). The second and third models used the data from School A and School B for reasons which will

be explained. In each description, a correlation matrix was included as well as basic regression statistics and the linear regression equation.

TABLE 21

CORRELATION MATRIX OF CONFIDENCE IN WIS-SIM VS. PSYCHOLOGICAL TYPE (SCHOOLS A-E)

Variable Name	Confidence in WIS-SIM	E/I	S/N	T/F	J/P
1. Confidence in WIS-SIM	1.000				
2. E/I	.037	1.000			
3. S/N	- .165	- .459	1.000		
4. T/F	- .039	- .229	.025	1.000	
5. J/P	- .255	- .145	.440	.251	1.000

TABLE 22

BASIC REGRESSION STATISTICS/CONFIDENCE IN WIS-SIM VS. PSYCHOLOGICAL TYPE (SCHOOLS A-E)

Variable Name	Type	Regression Coefficient	Partial F	Significance Level
1. Confidence in WIS-SIM	Dependent	---	---	---
	Constant	6.827	9.204	.004
2. E/I	Independent	-.002	.035	.853
3. S/N	Independent	-.005	.217	.643
4. T/F	Independent	.001	.009	.927
5. J/P	Independent	-.018	2.165	.147

Multiple Correlation Coefficient (R)	.264
Coefficient of Determination (R^2)	.070
F-Ratio (d.f.=4.53)	.99
Significance Level	.422

Based on the data from this procedure, the linear regression equation is as follows:

$$\hat{y} = 6.827 - .002X_1 - .005X_2 + .001X_3 - .018X_4$$

The obtained R in this analysis (.264) clearly indicates the equation was a poor model. R^2 indicates that only approximately 7 percent of the total variation of the measures of confidence in WIS-SIM was explained. The F-test for regression (i.e., the test of the null hypothesis $H_0: B_1=B_2=B_3=B_4=0$) was significant at only the .422 level.

An analysis of the plot of residuals versus residual confidence revealed a "horizontal band." Such a plot, indicating a random distribution of the residuals and a consequent lack of trend, showed no abnormality.

It further indicated that our confidence in the underlying assumptions required to interpret correctly a regression analysis was well founded. (These assumptions typically include independently normally distributed error with zero mean and constant variance.) (Draper & Smith, 1966, pp. 86-90). From the plot of residuals, however, one might infer the error was

dependent on some factor—in this case, the school from which the confidence measure was derived.

The confidence measure data (Table 9) indicated a strong disparity between confidence in WIS-SIM at School A versus School B (a mean difference of 2.91 was reported). This information was also consistent with the plot of residuals. In order to address this problem, two additional regression analyses were conducted. One treated the data from School A and School B separately while the other introduced a dummy variable and treated the two collectively. These results of the separate treatments are given in Tables 23-26.

TABLE 23

CORRELATION MATRIX OF CONFIDENCE IN WIS-SIM VS. PSYCHOLOGICAL TYPE (SCHOOL A)

Variable Name	Confidence in WIS-SIM	E/I	S/N	T/F	J/P
1. Confidence in WIS-SIM	1.000				
2. E/I	-.404*	1.000			
3. S/N	.239	-.505	1.000		
4. T/F	-.553**	.379	-.398	1.000	
5. J/P	-.316	.098	.366	.206	1.000

* Significant beyond .1 level

** Significant beyond .05 level

TABLE 24

BASIC REGRESSION STATISTICS/CONFIDENCE IN WIS-SIM VS. PSYCHOLOGICAL TYPE (SCHOOL A)

Variable Name	Type	Regression Coefficient	Partial F	Significance Level
1. Confidence in WIS-SIM	Dependent	---	---	---
	Constant	9.991	33.008	.0001
2. E/I	Independent	-.009	.600	.467
3. S/N	Independent	.002	.050	.826
4. T/F	Independent	-.017	2.602	.129
5. J/P	Independent	-.011	.859	.370

Multiple Correlation Coefficient (R)	.623
Coefficient of Determination (R^2)	.393
F-Ratio (d.f.=4,14)	2.26
Significance Level	.114

TABLE 25

CORRELATION MATRIX OF CONFIDENCE IN WIS-SIM
VS. PSYCHOLOGICAL TYPE (SCHOOL B)

Variable Name	Confidence in WIS-SIM	E/I	S/N	T/F	J/P
1. Confidence in WIS-SIM	1.000				
2. E/I	.261	1.000			
3. S/N	-.464*	-.709	1.000		
4. T/F	.171	-.594	.372	1.000	
5. J/P	-.210	-.413	.600	.294	1.000

* Significant beyond .1 level

TABLE 26

BASIC REGRESSION STATISTICS/CONFIDENCE IN WIS-SIM
VS. PSYCHOLOGICAL TYPE (SCHOOL B)

Variable Name	Type	Regression Coefficient	Partial F	Significance Level
1. Confidence in WIS-SIM	Dependent	---	---	---
	Constant	1.315	.057	.815
2. E/I	Independent	.012	.212	.653
3. S/N	Independent	-.036	2.320	.152
4. T/F	Independent	.040	2.728	.122
5. J/P	Independent	.004	.037	.851

Multiple Correlation Coefficient (R)	.605
Coefficient of Determination (R^2)	.366
F-Ratio (d.f.=4,13)	1.87
Significance Level	.175

Inspection of the School A correlation matrix (Table 26) indicated a relationship between E/I and confidence consistent with the theoretical framework (an increase on the E/I index reflects a tendency toward introversion). According to Jung's theory, a negative correlation was expected (i.e., orientation is to the outer world of things, people, and information as opposed to concepts and ideas). This correlation was significant beyond the .1 level. The negative correlation between T/F and confidence was also predicted by the theory (i.e., thinking types should favor objective information as opposed to subjective values). This correlation was significant beyond the .05 level.

The linear regression equation based on the School A data is as follows:

$$y = 9.991 - .009X_1 + .002X_2 - .017X_3 - .011X_4$$

This is not a very successful regression equation as can be noted from the statistics. It explains only 39 percent of the variance in the confidence in WIS-SIM measure.

Analysis of the School B data produced little useful insight into possible relationships except regarding the S/N correlation with confidence in WIS-SIM which was significant beyond the .1 level. This correlation was consistent with the theory in that sensing types should exhibit a reliance upon data and facts as opposed to possibilities.

The linear regression equation derived from the School B data is given below:

$$\hat{y} = 1.315 + .012X_1 - .036X_2 + .040X_3 + .004X_4$$

As in the case of the School A data, this equation did not represent a particularly useful expression for drawing conclusions about relationships between the variables. Little, if anything, could be inferred about the respective contributions of the variables and certainly neither equation served any predictive value.

Thus far, two analyses of the data regarding confidence in WIS-SIM versus psychological type have been presented. The first analysis treated the total sample in a conventional multiple regression process. The second treated School A and School B as separate samples. The third procedure treated School B and School B collectively in a multiple regression analysis with the inclusion of a dummy variable to reflect the difference between the two schools.

The use of a dummy variable in multiple regression takes account of the fact that various sources (e.g., School A and School B) may have separate deterministic effects on the response. In this analysis, dummy variables (0 and 1) were used to account for the two distinct blocks of data. Use of dummy variables in blocking prevented differences in average levels of confidence from obscuring the effects of the independent variables.

The results of this analysis are presented below.

TABLE 27

CORRELATION MATRIX OF CONFIDENCE IN WIS-SIM VS. PSYCHOLOGICAL TYPE (SCHOOL A AND SCHOOL B)

Variable Name	Confidence in WIS-SIM	E/I	S/N	T/F	J/P	
1. Confidence in WIS-SIM	1.000					
2. E/I	-.122	1.000				
3. S/N	-.126	-.561	1.000			
4. T/F	.015	-.145	-.096	1.000		
5. J/P	-.300	-.163	.458	.220	1.000	
6. Dummy	-.709	.221	.031	-.118	.190	1.000

TABLE 28

BASIC REGRESSION STATISTICS/CONFIDENCE IN WIS-SIM VS. PSYCHOLOGICAL TYPE (SCHOOL A AND SCHOOL B)

Variable Name	Type	Regression Coefficient	Partial F	Significance Level
1. Confidence in WIS-SIM	Dependent	---	---	---
	Constant	8.645	11.538	.002
6. Dummy	Independent	-2.701	26.814	.000
2. E/I	Independent	- .003	.064	.802
3. S/N	Independent	- .004	.160	.692
4. T/F	Independent	- .005	.127	.724
5. J/P	Independent	- .011	.792	.380

Multiple Correlation Coefficient (R) .731

Coefficient of Determination (R^2) .534

F-Ratio (d.f.=5.31) 7.10

Significance Level .0002

The linear equation for this model is as follows:

$$\hat{y} = 8.645 - .003X_1 - .004X_2 - .005X_3 - .011X_4 - 2.701X_5$$

Although this equation accounted for 53.4 percent of the variance of the dependent variable, it did not provide any additional information with regard to contributions of the independent variables (except the source school represented by the dummy variable). As in the case of the previous models, it was

impossible to infer that one index of psychological type contributed more than another.

Based on the analysis which treats School A and School B separately, it was concluded that a relationship did exist between certain facets of psychological type and confidence in WIS-SIM. The School A analysis indicated a significant correlation between the indices E/I and T/F with confidence while the School B data indicated a significant correlation between the S/N index and confidence. The direction of these indices in all cases was consistent with the theory based on the Jungian framework.

The linear equation derived by multiple regression including the introduction of a dummy variable appeared useful as a model to analyze confidence in School A and School B as a function of psychological type. The significance level (.0002) certainly indicated that this was a successful model for the data. As the regression statistics indicated, however, the only significant coefficient was that of the dummy variable representing the school source.

Given the analysis of these data, the following conclusions were drawn with respect to Hypothesis II:

- Based on the data derived from the complete set of WIS-SIM pilot test schools, no significant linear relationship existed between the psychological type

of WIS-SIM user and the user's confidence in WIS-SIM. Further inspection of the data indicated a higher order relationship did not exist. Therefore, Hypothesis II was not rejected.

- The analysis of data obtained from School A and School B, respectively, showed a significant relationship between the E/I and T/F indices (School A) and the S/N index (School B). The direction of the relationships was consistent with the theoretical framework in all cases.
- Although the conclusion was reached that Hypothesis II should be accepted, this verdict must be tempered by the observation that the relationship was not totally independent of other influences. Many questions were raised regarding dependence of the parameters upon their respective source.

Usefulness of WIS-SIM as a Function of Psychological Type. Hypothesis III concerns the relationship between the usefulness of WIS-SIM and the psychological type of the user. Hypothesis III is stated as follows:

> There is no significant relationship between the psychological type of the WIS-SIM user and the user's perception of WIS-SIM's usefulness as an instructional decision-support system.

This hypothesis was tested through the use of correlations between the obtained measures of perception of WIS-SIM usefulness

and the four psychological type indices (E/I, S/N, T/F, and J/P) for the respective respondents included in the sample derived from WIS-SIM pilot test schools. These data were also used to generate linear regression equations describing the measures. Perception of WIS-SIM usefulness was treated as the dependent variable and the four psychological type indices as independent variables. Several linear regression equations were generated using stepwise multiple regression but only the final model including all variables was reported. The first model included data from all WIS-SIM pilot test schools. The same format was used as in the preceding sections.

TABLE 29

CORRELATION MATRIX OF PERCEPTION OF WIS-SIM USEFULNESS VS. PSYCHOLOGICAL TYPE (SCHOOLS A-E)

Variable Name	Usefulness of WIS-SIM	E/I	S/N	T/F	J/P
1. Usefulness of WIS-SIM	1.000				
2. E/I	-.265**	1.000			
3. S/N	.026	-.459	1.000		
4. T/F	-.097	-.229	.025	1.000	
5. J/P	-.080	-.145	.440	.251	1.000

** Significant beyond .05 level

TABLE 30

BASIC REGRESSION STATISTICS/PERCEPTION OF WIS-SIM USEFULNESS VS. PSYCHOLOGICAL TYPE (SCHOOLS A-E)

Variable Name	Type	Regression Coefficient	Partial F	Significance Level
1. Usefulness of WIS-SIM	Dependent	---	---	---
	Constant	10.190	16.528	.0002
2. E/I	Independent	-.029	5.749	.020
3. S/N	Independent	-.008	.542	.465
4. T/F	Independent	-.016	1.448	.234
5. J/P	Independent	-.003	.060	.808

Multiple Correlation Coefficient (R) .335

Coefficient of Determination (R^2) .112

F-Ratio (d.f.=4,53) 1.68

Significance Level .168

Based on the above data, the linear regression equation was generated:

$$\hat{y} = 10.19 - .029X_1 - .008X_2 - .016X_3 - .003X_4$$

The negative correlation (- 265) between perception of WIS-SIM usefulness and the E/I type index was significant beyond the .05 level. The direction of this correlation was consistent with the theoretical framework. The linear regression, however, was not useful, as it explained only 11.2 percent of the variance in the measure of perception of usefulness.

The data obtained from Schools A-E were treated separately as well as collectively. As in the other analyses, dummy variables were introduced into the equations to account for source.

The analysis of the School A data is presented in Tables 31 and 32.

TABLE 31

CORRELATION MATRIX OF PERCEPTION OF WIS SIM USEFULNESS VS. PSYCHOLOGICAL TYPE (SCHOOL A)

Variable Name	Usefulness of WIS-SIM	E/I	S/N	T/F	J/P
1. Usefulness of WIS-SIM	1.000				
2. E/I	-.036	1.000			
3. S/N	.461*	-.130	1.000		
4. T/F	-.512**	.144	-.476	1.000	
5. J/P	-.154	-.036	.402	.228	1.000

* Significant beyond .1 level

** Significant beyond .05 level

TABLE 32

BASIC REGRESSION STATISTICS/PERCEPTION OF WIS-SIM USEFULNESS VS. PSYCHOLOGICAL TYPE (SCHOOL A)

Variable Name	Type	Regression Coefficient	Partial F	Significance Level
1. Usefulness of WIS-SIM	Dependent	---	---	---
	Constant	7.629	6.467	.025
2. E/I	Independent	.003	.046	.833
3. S/N	Independent	.022	2.390	.146
4. T/F	Independent	-.017	.584	.458
5. J/P	Independent	-.023	1.102	.313

Multiple Correlation Coefficient (R)	.616
Coefficient of Determination (R^2)	.379
F-Ratio (d.f.=4,13)	1.98
Significance Level	.157

Significant correlations were observed between the S/N and T/F indices and perception of WIS-SIM usefulness in the analysis of the data obtained from School A. The direction of the correlation between the T/F index and usefulness was in complete agreement with the theoretical framework. Jung's theory suggested that thinking types would be oriented to logical processes or objective methods with a tendency toward systemization. It was consistent with this proposition to

assume that such types would find a management information system such as WIS-SIM a useful decision-support device.

The linear regression equation based on the School A data was determined to be:

$$\hat{y} = 7.629 - .003X_1 + .022X_2 - .017X_3 - .023X_4$$

It was not possible to determine significant influences introduced by the respective independent variables. The possible exception was the S/N variable which was significant at the .146 level ($H_0:B_2=0$).

Analyses of the School B-E data were performed but no significant evidence was found to indicate significant correlation. Analyses of the data using introduced dummy variables for blocking purposes also provided no useful or additional information.

As a result of the preceding analyses, the following conclusion was drawn with respect to Hypothesis III:

- A relationship existed between the E/I type index and the user's perception of WIS-SIM usefulness. This relationship was significant at the .05 level. Analysis of the School A data as a separate group also indicated relationships between the S/N and T/F type indices and perception of WIS-SIM usefulness. Based on these findings, Hypothesis III was rejected.

Level of WIS-SIM Usage as Function of Psychological Type. Hypothesis IV addresses this relationship and is stated as follows:

There is no significant relationship between the psychological type of the WIS-SIM user and the level of system usage.

The Jungian theory suggests that different psychological types exhibit different preferences with regard to information. Individuals can receive information from their environment by either sensation or intuition but not by both simultaneously. This, of course, leads to the phenomena termed "preference" discussed in Chapter I. The sensation type prefers hard, impersonal facts while the intuition type typically receives information by seeing the whole--the gestalt--of any given situation.

The theory also proposes there exist two basic ways of reaching a decision: thinking and feeling. Thinking is an impersonal, analytical mode of reasoning. Feeling is a process that is based on personalistic, value judgements.

This framework suggests that the WIS-SIM user who is a sensation/thinking type would be more receptive and amenable to the instructional management support information provided by the CMI system than the intuition/feeling type combination. A possible inference which may be drawn from this user/system interface relates to level of system usage as set forth in Hypothesis IV.

The absence of appropriate data prevented this hypothesis from being tested in a rigorous manner. Two sites were available

for the collection of data necessary to address this hypothesis--School A and School B. School B was not considered a suitable site at which to collect these data due to its organizational structure. All WIS-SIM usage and report requests originated from one person--the school reading specialist. Therefore, the overall school usage level was not necessarily a function of the psychological type composition of the collective faculty. Because the reading specialist serves as a coordinator and liason, usage was also not an exclusive function of her psychological type.

In School A, WIS-SIM usage was not directly traceable to specific individuals (i.e., report requests were not generated by individuals alone). Rather, many of the requests (in some instructional units, all of the requests) were initiated as a result of group or unit consensus as to their needs and requirements. Consequently, it was impossible to trace the origin of a system report or access to a given person--only to an instructional unit.

A measure of psychological type of a group was not possible within the limitations imposed by the MBTI used to operationalize Jung's theory. Techniques such as averaging psychological type were misleading and highly inaccurate. For example, the mean of two individuals reflecting sensation and intuition preferences,

respectively, would indicate a composite absense of preference. This was due to the dichotomous nature of the type indices.

In order to provide some information and insight with regard to the relationship set forth in Hypothesis IV, a two-week sample of WIS-SIM report requests in School A was obtained for the 1977-78 school year. These data included number of reports, type of reports, and unit requesting the reports. Although a rigorous statistical examination was not possible, an inspection of the data led to the following conclusion:

- Although a statistical test was not possible, inspection of the distribution of psychological types in the instructional units of School A revealed no apparent differences. Therefore, any disparities in levels of usage could not be attributed to psychological type. This information led to the possible acceptance of Hypothesis IV.

Discussion of Ancillary Questions

Relationship Between Psychological Type and Success/Failure. The first ancillary question raised addressed the issue of psychological type and its relationship to the success or failure of WIS-SIM in a pilot test school. This question was stated as follows:

> Is there a significant relationship between the psychological type of the WIS-SIM user

in a pilot school and the success or failure of the system in that school?

Success of the system, as used in the context of this question, referred to and was defined as the desire by the user (school) to continue using WIS-SIM as contrasted with failure of the system, which referred to the user's electing to terminate usage of the system.

This question was not included as a hypothesis because of its heuristic nature. There were clearly a host of factors in addition to psychological type which may have contributed to success or failure. These could have included such determinants as school district instability, lack of administrative support, inadequate personnel inservice, lack of perceived need for the system, and technical problems associated with the system.

The schools defined as successful were School A and School B, while the unsuccessful schools were defined as Schools C, D, and E. Given this classification, discriminant analysis using the MULTIVARIANCE computer program was used to determine if the four indices of psychological type provided sufficient classificatory information. The results of this analysis are presented in Table 33.

The best statistic to test the null hypothesis that the discriminant function did not discriminate between the two

TABLE 33

DISCRIMINANT FUNCTION ANALYSIS (FOUR VARIABLES)

Variable	Raw Coefficient	Standardized
E/I	-.03175	-.8399
S/N	-.03242	-.9635
T/F	-.03080	-.6701
J/P	.00273	.0641

Hotelling's Trace Criterion	.0748
Bartlett's Chi-Square	3.8944 ($\alpha < .4205$)
F-ratio	.4867 ($\alpha < .745$)

groups (successful and unsuccessful users) is an F-test, which as shown in Table 33 was .4867 (d.f.=4,53). This discriminant function was not acceptable and therefore it was concluded that psychological type did not represent a discriminating or classificatory variable.

Relationship Between Additional Variables and Success/Failure. The second ancillary question concerned the following relationship.

Is there a significant difference in the contribution of the following variables to the success or failure of the system?

a) Psychological type of user

b) Apprehension of user toward man-machine systems

c) Confidence of user in WIS-SIM

d) User perception of usefulness

e) User perception of adequacy of consultive support provided

The measures used in b, c, and d were provided by the same instruments used in the tests of Hypotheses I, II, and III. The level of user perception of adequacy of consultive support provided was obtained through surveys of the WIS-SIM users. Users were asked to rank their estimation of this variable on a 9-point scale.

These measures were analyzed using discriminant function analysis. The MULTIVARIANCE computer program was used again in this test. The results are presented in Table 34.

This analysis indicated that the eight variables did provide sufficient classificatory information. The variables addressing confidence in WIS-SIM and perception of consultive support introduced the highest degree of discrimination between the two groups.

Comparison of Distribution of Types. A third ancillary question concerned the distribution of personnel according to

TABLE 34

DISCRIMINANT FUNCTION ANALYSIS (EIGHT VARIABLES)

Variable	Raw Coefficient	Standardized
1. Usefulness	.04232	.0839
2. Apprehension	-.00737	-.0096
3. Confidence	-.41743	-.7258
4. Perception of Consultive Support	.99263	1.3160
5. E/I	.00481	.1272
6. S/N	-.06467	-.1389
7. T/F	-.00639	-.1390
8. J/P	.00565	.1328

Hotelling's Trace Criterion	3.2207
Bartlett's Chi-Square	74.8801 ($\alpha < .0001$)
F-Ratio	13.9728 ($\alpha < .0001$)

psychological type in the WIS-SIM user schools as compared with distribution of IGE elementary teachers in non-CMI schools.

Question III addressed this as follows:

> Is there a significant difference between the population distribution of psychological type among IGE elementary teachers and the population distribution of the WIS-SIM user schools?

This question was generated through an interest in determining if a unique distribution of types within a given school might be a contributing factor to the acceptance or rejection of a management information system such as WIS-SIM. Whereas the previous discussions related to the hypotheses concerned the relationship of certain constructs (apprehension, confidence, usefulness, and level of usage), this question only concerns the distribution of types in different WIS-SIM schools compared with a base defined by a set of teachers in non-CMI elementary schools.

The set of elementary teachers from non-CMI IGE schools represented a sample size of 65, composed of teachers from five elementary schools. The type distribution of each of the five WIS-SIM user schools was compared with this base type distribution.

One method used to compare the respective pairs of samples was through an examination of the frequency of a given type in one sample to the frequency of that type in the other sample. The ratio of the percent of a given type in one sample to the percent of that type in another sample provided an index for comparison. If a sample contained more than the expected number of a given type, the index was greater than 1.0. If the sample contained less than expected, the index was less than 1.0. This index is denoted by I in the tables.

Another method used to compare the pairs of samples was through a contingency table and application of the chi-square statistic. This presented some problem due to the requirements that the minimum number of entries in a given cell be between 2 and 10 (depending upon the reference source). In the cases where the frequency of a type was less than 5, an alternate test statistic, the Fisher Exact Probability Test, was employed.

The computer program utilized in this problem was the Selection Ratio Type Table (SRTT), a program developed at the University of Florida for type distribution comparisons using the MBTI. The program provided the following data:

- Cell frequencies (N)
- Cell percent of total sample (%)
- Index of comparison with base (I)
- Chi-square or Fisher Exact Probability Test and significance levels

The results of the distribution analyses are presented in Tables 36-40.

Analysis of these tables indicated that the samples did not, in general, differ significantly from the base. An interesting difference, however, was observed in the School A data. The index with respect to ESFJ types was 5.70 (i.e., the percent of this type at School A was 5.7 times as great as

TABLE 35

PSYCHOLOGICAL TYPE DISTRIBUTION (NON-CMI SCHOOLS/BASE FOR COMPARISONS)

SENSING TYPES WITH THINKING	SENSING TYPES WITH FEELING	INTUITIVE TYPES WITH FEELING	INTUITIVE TYPES WITH THINKING			N	%
					E	29	44.62
I S T J	I S F J	I N F J	I N T J	J	I	36	55.38
				U			
				D	S	32	49.23
N= 3	N= 12	N= 3	N= 2	G	N	33	50.77
				I			
%= 4.62	%=18.46	%= 4.62	%= 3.08	N I	T	19	29.23
				G N	F	46	70.77
				T			
				R	J	36	55.38
				O	P	29	44.62
I S T P	I S F P	I N F P	I N T P	V			
				E	IJ	20	30.77
				R	IP	16	24.62
N= 1	N= 5	N= 7	N= 3	T			
				S	EP	13	20.00
%= 1.54	%= 7.69	%=10.77	%= 4.62	P	EJ	16	24.62
				E			
				R	ST	8	12.31
				C	SF	24	36.92
				E			
E S T P	E S F P	E N F P	E N T P	P	NF	22	33.85
				T	NT	11	16.92
				I			
N= 1	N= 4	N= 4	N= 4	V	SJ	21	32.31
				E	SP	11	16.92
%= 1.54	%= 6.15	%= 6.15	%= 6.15	S E			
				X	NP	18	27.69
				T	NJ	15	23.08
				R			
				A	TJ	10	15.38
E S T J	E S F J	E N F J	E N T J	J V	TP	9	13.85
				U E			
				O R	FP	20	30.77
N= 3	N= 3	N= 8	N= 2	G T	FJ	26	40.00
				I S			
%= 4.62	%= 4.62	%=12.31	%= 3.08	N	IN	15	23.08
				G	EN	18	27.69
					IS	21	32.31
					ES	11	16.92

TABLE 36

PSYCHOLOGICAL TYPE DISTRIBUTION COMPARISON (SCHOOL A VS. NON-CMI SCHOOL BASE)

SENSING TYPES WITH THINKING	SENSING TYPES WITH FEELING	INTUITIVE TYPES WITH FEELING	INTUITIVE TYPES WITH THINKING			N	%	I
					E	15	78.95	1.77#
I S T J	I S F J	I N F J	I N T J	J	I	4	21.05	.38#
				U				
				D	S	11	57.89	1.18
N= 0	N= 3	N= 0	N= 0	G	N	8	42.11	.83
				I				
%= .00	%=15.79	%= .00	%= .00	N I	T	4	21.05	.72
				G N	F	15	78.95	1.12
I= .00	I= .86	I= .00	I= .00	T				
				R	J	16	84.21	1.52"
				O	P	3	15.79	.35"
I S T P	I S F P	I N F P	I N T P	V				
				E	IJ	3	15.79	.51
				R	IP	1	5.26	.21
N= 0	N= 0	N= 1	N= 0	T				
				S	EP	2	10.53	.53
%= .00	%= .00	%= 5.26	%= .00	P	EJ	13	68.42	2.78*
				E				
I= .00	I= .00	I= .49	I= .00	R	ST	2	10.53	.86
				C	SF	9	47.37	1.28
				E				
E S T P	E S F P	E N F P	E N T P	P	NF	6	31.58	.93
				T	NT	2	10.53	.62
				I				
N= 0	N= 1	N= 1	N= 0	V	SJ	10	52.63	1.63
				E	SP	1	5.26	.31
%= .00	%= 5.26	%= 5.26	%= .00	S E				
				X	NP	2	10.53	.38
I= .00	I= .86	I= .86	I= .00	T	NJ	6	31.58	1.37
				R				
				A	TJ	4	21.05	1.37
E S T J	E S F J	E N F J	E N T J	J V	TP	0	.00	.00
				U E				
				D R	FP	3	15.79	.51
N= 2	N= 5	N= 4	N= 2	G T	FJ	12	63.16	1.58
				I S				
%=10.53	%=26.32	%=21.05	%=10.53	N	IN	1	5.26	.23
				G	EN	7	36.84	1.33
I= 2.28	I= 5.70"	I= 1.71	I= 3.42					
					IS	3	15.79	.49
					ES	8	42.11	2.49"

Note concerning symbols following the indices:

" implies significance at the .05 level (i.e., chi sq. $>$ 3.8);
implies significance at the .01 level (i.e., chi sq. $>$ 6.6);
* implies significance at the .001 level (i.e., chi sq. $>$ 10.8).
_ (underscore) indicates Fisher's Exact Probability used instead of chi-square.

TABLE 37

PSYCHOLOGICAL TYPE DISTRIBUTION COMPARISON (SCHOOL B VS. NON-CMI SCHOOL BASE)

SENSING TYPES WITH THINKING	SENSING TYPES WITH FEELING	INTUITIVE TYPES WITH FEELING	INTUITIVE TYPES WITH THINKING			N	%	I
					E	10	52.63	1.18
I S T J	I S F J	I N F J	I N T J	J	I	9	47.37	.86
				U				
				D	S	12	63.16	1.28
N= 3	N= 3	N= 0	N= 0	G	N	7	36.84	.73
				I				
%=15.79	%=15.79	%= .00	%= .00	N I	T	9	47.37	1.62
				G N	F	10	52.63	.74
I= 3.42	I= .86	I= .00	I= .00	T				
				R	J	12	63.16	1.14
				O	P	7	36.84	.83
I S T P	I S F P	I N F P	I N T P	V				
				E	IJ	6	31.58	1.03
				R	IP	3	15.79	.64
N= 2	N= 0	N= 0	N= 1	T				
				S	EP	4	21.05	1.05
%=10.53	%= .00	%= .00	%= 5.26	P	EJ	6	31.58	1.28
				E				
I= 6.84	I= .00	I= .00	I= 1.14	R	ST	8	42.11	3.42*
				C	SF	4	21.05	.57
				E				
E S T P	E S F P	E N F P	E N T P	P	NF	6	31.58	.93
				T	NT	1	5.26	.31
				I				
N= 1	N= 0	N= 3	N= 0	V	SJ	9	47.37	1.47
				E	SP	3	15.79	.93
%= 5.26	%= .00	%=15.79	%= .00	S E				
				X	NP	4	21.05	.76
I= 3.42	I= .00	I= 2.57	I= .00	T	NJ	3	15.79	.68
				R				
				A	TJ	5	26.32	1.71
E S T J	E S F J	E N F J	E N T J	J V	TP	4	21.05	1.52
				U E				
				D R	FP	3	15.79	.81
N= 2	N= 1	N= 3	N= 0	G T	FJ	7	36.84	.92
				I S				
%=10.53	%= 5.26	%=15.79	%= .00	N	IN	1	5.26	.23
				G	EN	6	31.58	1.14
I= 2.28	I= 1.14	I= 1.28	I= .00					
					IS	8	42.11	1.30
					ES	4	21.05	1.24

Note concerning symbols following the indices:

" implies significance at the .05 level (i.e., chi sq.> 3.8);
implies significance at the .01 level (i.e., chi sq.> 6.6);
* implies significance at the .001 level (i.e., chi sq.> 10.8).
_ (underscore) indicates Fisher's Exact Probability used instead of chi-square.

TABLE 38

PSYCHOLOGICAL TYPE DISTRIBUTION COMPARISON
(SCHOOL C VS. NON-CMI SCHOOL BASE)

SENSING TYPES WITH THINKING	SENSING TYPES WITH FEELING	INTUITIVE TYPES WITH FEELING	INTUITIVE TYPES WITH THINKING			N	%	I
					E	2	40.00	.90
I S T J	I S F J	I N F J	I N T J	J U D G E	I	3	60.00	1.08
					S	2	40.00	.81
N= 0	N= 1	N= 0	N= 1		N	3	60.00	1.18
				I N T U I T I V E	T	2	40.00	1.37
%= .00	%=20.00	%= .00	%=20.00		F	3	60.00	.85
I= .00	I= 1.08	I= .00	I= 6.50		J	4	80.00	1.44
					P	1	20.00	.45
I S T P	I S F P	I N F P	I N T P		IJ	2	40.00	1.30
					IP	1	20.00	.81
N= 0	N= 1	N= 0	N= 0		EP	0	.00	.00
					EJ	2	40.00	1.62
%= .00	%=20.00	%= .00	%= .00		ST	0	.00	.00
I= .00	I= 2.60	I= .00	I= .00		SF	2	40.00	1.08
					NP	1	20.00	.59
E S T P	E S F P	E N F P	E N T P		NT	2	40.00	2.34
					SJ	1	20.00	.62
N= 0	N= 0	N= 0	N= 0		SP	1	20.00	1.18
					NP	0	.00	.00
%= .00	%= .00	%= .00	%= .00		NJ	3	60.00	2.60
I= .00	I= .00	I= .00	I= .00		TJ	2	40.00	2.48
					TP	0	.00	.00
E S T J	E S F J	E N F J	E N T J		FP	1	20.00	.65
N= 0	N= 0	N= 1	N= 1		FJ	2	40.00	1.08
					IN	1	20.00	.87
%= .00	%= .00	%=20.00	%=20.00		EN	2	40.00	1.44
I= .00	I= .00	I= 1.62	I= 6.50		IS	2	40.00	1.24
					ES	0	.00	.00

Note concerning symbols following the indices:

" implies significance at the .05 level (i.e., chi sq. > 3.8);
implies significance at the .01 level (i.e., chi sq. > 6.6);
* implies significance at the .001 level (i.e., chi sq. > 10.8).
_ (underscore) indicates Fisher's Exact Probability used instead of chi-square.

TABLE 39

PSYCHOLOGICAL TYPE DISTRIBUTION COMPARISON (SCHOOLS D AND E VS. NON-CMI SCHOOL BASE)

SENSING TYPES WITH THINKING	SENSING TYPES WITH FEELING	INTUITIVE TYPES WITH FEELING	INTUITIVE TYPES WITH THINKING			N	%	I
					E	9	56.25	1.26
I S T J	I S F J	I N F J	I N T J	J	I	7	43.75	.79
				U				
				D	S	8	50.00	1.02
N= 1	N= 1	N= 3	N= 0	G	N	8	50.00	.98
				I				
%= 6.25	%= 6.25	%=18.75	%= .00	N I	T	1	6.25	.21
				G N	F	15	93.75	1.32
I= 1.35	I= .34	I= 4.04	I= .00	T				
				R	J	10	62.50	1.13
				O	P	6	37.50	.84
I S T P	I S F P	I N F P	I N T P	V				
				E	IJ	5	31.25	1.02
				R	IP	2	12.50	.51
N= 0	N= 2	N= 0	N= 0	T				
				S	EP	4	25.00	1.25
%= .00	%=12.50	%= .00	%= .00	P	EJ	5	31.25	1.27
				E				
I= .00	I= 1.62	I= .00	I= .00	R	ST	1	6.25	.51
				C	SF	7	43.75	1.18
				E				
E S T P	E S F P	E N F P	E N T P	P	NF	8	50.00	1.48
				T	NT	0	.00	.00
				I				
N= 0	N= 1	N= 3	N= 0	V	SJ	5	31.25	.97
				E	SP	3	18.75	1.11
%= .00	%= 6.25	%=18.75	%= .00	S E				
				X	NP	3	18.75	.68
I= .00	I= 1.62	I= 3.05	I= .00	T	NJ	5	31.25	1.35
				R				
				A	TJ	1	6.25	.41
E S T J	E S F J	E N F J	E N T J	J V	TP	0	.00	.00
				U E				
				D R	FP	6	37.50	1.22
N= 0	N= 3	N= 2	N= 0	G T	FJ	9	56.25	1.41
				I S				
%= .00	%=18.75	%=12.50	%= .00	N	IN	3	18.75	.81
				G	EN	5	31.25	1.13
I= .00	I= 4.06	I= 1.02	I= .00					
					IS	4	25.00	.77
					FS	4	25.00	1.48

Note concerning symbols following the indices:

" implies significance at the .05 level (i.e., chi sq. > 3.8);
implies significance at the .01 level (i.e., chi sq. > 6.6);
* implies significance at the .001 level (i.e., chi sq. > 10.8).
_ (underscore) indicates Fisher's Exact Probability used instead of chi-square.

TABLE 40

PSYCHOLOGICAL TYPE DISTRIBUTION COMPARISON (ALL WIS-SIM PILOT TEST SCHOOLS VS. NON-CMI SCHOOL BASE)

SENSING TYPES WITH THINKING	SENSING TYPES WITH FEELING	INTUITIVE TYPES WITH FEELING	INTUITIVE TYPES WITH THINKING			N	%	I
					E	36	62.07	1.39
I S T J	I S F J	I N F J	I N T J	J	I	22	37.93	.68
				U				
				D	S	32	55.17	1.12
N= 4	N= 8	N= 3	N= 1	G	N	26	44.83	.88
				I				
%= 6.90	%=13.79	%= 5.17	%= 1.72	N I	T	15	25.86	.88
				G N	F	43	74.14	1.05
I= 1.49	I= .75	I= 1.12	I= .56	E T				
				R	J	42	72.41	1.31"
				D	P	16	27.59	.62"
I S T P	I S F P	I N F P	I N T P	V				
				E	IJ	16	27.59	.90
				R	IP	6	10.34	.42"
N= 1	N= 3	N= 1	N= 1	T				
				S	EP	10	17.24	.86
%= 1.72	%= 5.17	%= 1.72	%= 1.72	P	EJ	26	44.83	1.82"
				E				
I= 1.12	I= .67	I= .16	I= .37	R	ST	10	17.24	1.40
				C	SF	22	37.93	1.03
				E				
E S T P	E S F P	E N F P	E N T P	P	NF	21	36.21	1.07
				T	NT	5	8.62	.51
				I				
N= 1	N= 2	N= 7	N= 0	V	SJ	25	43.10	1.33
				E	SP	7	12.07	.71
%= 1.72	%= 3.45	%=12.07	%= .00	S E				
				X	NP	9	15.52	.56
I= 1.12	I= .56	I= 1.96	I= .00	T	NJ	17	29.31	1.27
				R				
				A	TJ	12	20.69	1.34
E S T J	E S F J	E N F J	E N T J	J V	TP	3	5.17	.37
				U E				
				D R	FP	13	22.41	.73
N= 4	N= 9	N= 10	N= 3	G T	FJ	30	51.72	1.29
				I S				
%= 6.90	%=15.52	%=17.24	%= 5.17	N	IN	6	10.34	.45
				G	EN	20	34.48	1.25
I= 1.49	I= 3.36	I= 1.40	I= 1.68					
					IS	16	27.59	.85
					ES	16	27.59	1.63

Note concerning symbols following the indices:

" implies significance at the .05 level (i.e., chi sq. > 3.8);
implies significance at the .01 level (i.e., chi sq. > 6.6);
* implies significance at the .001 level (i.e., chi sq. > 10.8).
_ (underscore) indicates Fisher's Exact Probability used instead of chi-square.

observed in the base sample) and was significant at the .05 level. The E types' index was 1.70 which was significant at the .01 level. The direction of these observations was consistent with the prediction of Jung's theory, given that School A was clearly the most extensive user of WIS-SIM. The J types' index was 1.52 and this was also consistent with the theoretical framework.

Chapter Summary

This chapter contained the analysis of data collected in an effort to address the hypotheses and questions raised in Chapter I. The first related to the reliability and validity of the three instruments used to measure confidence in WIS-SIM, perception of the usefulness of WIS-SIM, and apprehension of man-machine systems. Reliability estimates obtained using the internal consistency method indicated all three instruments were acceptable.

The second section included data derived from the three questionnaires at the participating schools. The results were much as anticipated, showing that School A exhibited the highest confidence and perceived usefulness of the system as well as the lowest apprehension of man-machine systems.

Section three presented profiles of respondents participating in the study. These profiles included general demographic

data and distributions of psychological types in each school. Psychological types were specified by the 16 principal classifications as well as the major sub-classifications.

The data related to the central issues of the research are included in section four. These data address the relationships between the apprehension, confidence, and usefulness constructs and psychological types as specified in Hypotheses I-IV. The analyses led to the acceptance of Hypotheses I and II (i.e., no significant relationships existed) while Hypothesis III was rejected (i.e., a significant relationship was detected between the user's perception of WIS-SIM usefulness and psychological type). Hypothesis IV was not subjected to a rigorous test due to the unavailability of the requisite and appropriate data.

The three ancillary questions raised in Chapter I were addressed in section five. With respect to Questions I and II, it was found that the four psychological type indices did not discriminate between successful and unsuccessful users. However, the addition of four variables (described in Question II) did provide a classificatory model. The final data analysis compared the psychological type distributions as specified in Question III. This comparison showed that the samples did not, in general, differ from the base. The one exception was the School A data.

CHAPTER IV

SUMMARY, FINDINGS, AND CONCLUSIONS

In this chapter, a brief overview of the study and the findings derived from the analysis of data are presented. Attention is also given to inferences which may be drawn from the information obtained from the research and to implications for future investigations.

Summary of the Study

This study was part of a program of research on computer supported management information systems in education. Specifically, the study was designed to investigate the implementation and utilization of the Wisconsin System for Instructional Management (WIS-SIM), a computer managed instruction system. The purpose of the study was to explore the relationships between psychological types of users of WIS-SIM and factors associated with implementation and utilization of the system. These factors included apprehension of man-machine systems, confidence in WIS-SIM, and perception of usefulness of WIS-SIM.

Much of the conceptual framework of this study embraced characteristics of management information systems (MIS). A MIS was defined as a set of correlated elements which serves the

purpose of processing data to provide information that assists management functions. The potential for difference in information requirements, as well as the varying complexity of a MIS within the levels of an organizational structure, were explored as possible contributors to the lack of understanding and failure of a MIS.

WIS-SIM was demonstrated to be a MIS which provides support for instructional management in addition to assisting teachers with the requisite record keeping and clerical tasks. The purpose of this computer managed instruction system was to utilize the computer to optimize the learning environment and to maximize educational progress while making efficient use of school resources.

The primary theoretical framework of the study was based on the Jungian theory of psychological types (Jung, 1923). The theory was considered appropriate when interfaced with the conceptual structure of management information systems and specifically the WIS-SIM system. Jung's theory proposed that apparent random variations in human behavior are in fact orderly and consistent. Specifically, these variations in human behavior were explained as a function of the way people prefer to use perception and judgement. The two contrasting modes of perception are sensation and intuition, while the two modes of judgement are thinking and feeling. These four

psychological preferences may occur in combination with introverted or extraverted personality differences and with the way persons favor using judgement or perception to produce a total of 16 type combinations.

Relationships between psychological types of WIS-SIM users and four constructs (apprehension of man-machine systems, confidence in WIS-SIM, perception of usefulness of WIS-SIM, and level of system usage) were set forth in four hypotheses. In addition, three ancillary questions were raised concerning variables contributing to successful WIS-SIM implementation and distribution of psychological types within the samples.

The study was considered to have important potential for directing future MIS design and implementation efforts. It also provided a foundation for future research in information analysis, theory of evidence generators, and decision support systems.

The design of the study was correlational research as it utilized correlational techniques to examine relationships between certain constructs identified in the conceptual framework. The population specified in the design was the set of teachers in IGE schools. A subset of this population was the set of WIS-SIM users.

The respondents in this study were the teachers and administrators in the WIS-SIM pilot test schools between 1975

and 1977. Seven schools, located in four Wisconsin school districts, participated in the pilot test. Although the schools varied widely in size, structure, and organizational arrangements, all used the IGE model. A second sample set was established, and consisted of IGE teachers in schools not using CMI. This set was used for psychological type distribution comparisons.

Four instruments were utilized in this study:

- The Myers-Briggs Type Indicator
- Confidence in WIS-SIM questionnaire
- Perception of usefulness of WIS-SIM questionnaire
- Apprehension of man-machine systems questionnaire

The Myers-Briggs Type Indicator (MBTI) was designed explicitly to operationalize Jung's theory of psychological type. The MBTI provided four indices (EI, SN, TF, and JP) for determining each of the four basic preferences which, under Jung's theory, structure the individual's personality. Research indicated the MBTI to be an appropriate and acceptable instrument for operationalizing the constructs set forth in the conceptual framework of the study.

The three attitude and perception instruments were closed form questionnaires, utilizing a Likert scale, The items related to degrees of agreement or disagreement with the associated issues.

Analysis of data obtained in the study included the following:

- Reliability analysis of the above three instruments
- General data analysis (descriptive statistics on scores from the above three instruments)
- Staff demographic data
- Psychological type distribution profiles of participating schools
- Statistical tests of hypotheses
- Statistical examination of ancillary questions

This analysis was presented in Chapter III and included all relevant statistical data which led to the acceptance or rejection of the four hypotheses and to examination of the three ancillary questions.

Findings of the Study

The findings of this study with respect to the role of psychological type in the implementation and utilization of WIS-SIM are presented in this section. Each hypothesis and ancillary question is addressed individually.

Major Findings

Hypothesis I. Hypothesis I was stated as follows:

> There is no significant relationship between the psychological type of the

WIS-SIM user and the user's apprehension of man-machine systems.

Although the statistical tests of Hypothesis I were not conclusive, several findings were derived regarding the relationship between type and apprehension of man-machine systems. Examination of the statistical analyses produced the following information.

- Based on the complete set of respondents, no relationship was detected between psychological type and apprehension of man-machine systems.
- Based on the School A data alone, a significant correlation was found between introverts and apprehension and between sensation types and apprehension. A relationship which approached statistical significance was also observed between feeling types and apprehension.
- In Schools C, D, and E, a statistically significant relationship was found between a judging preference and apprehension.

The Jungian theoretical framework suggests that since the extravert's main interests are in the outer world or the outer environment of people and things, he or she is more likely to be receptive to information, ideas, and concepts from an external source as compared to the introvert who prefers to generate ideas from within. An analysis of the distribution

of psychological types in the School A (Table 36) indicated 79 percent of the faculty to be E (extraverted) types. Given that School A was, by far, the most extensive user of WIS-SIM, this would appear to substantiate the observation in the School A data which indicated a strong relationship between extraversion and positive feelings about man-machine systems.

Constructs related to apprehension of man-machine systems, anxiety associated with the implementation of computer-supported MIS, and the general fear associated with the application of technological devices in social systems may be the most important variable suggested by the conceptual framework of this study. Unfortunately, it may also be the most difficult to quantify with any satisfactory degree of validity. These constructs, although on the surface reasonably straightforward, apparently are a function of a host of temporal sub-dimensions. For example, teachers may not readily accept the use of a computer for record keeping and instructional decision support until they have had reasonable experience with such technology. Anxiety is, in such cases, associated with the unknown. Alternatively, teachers may have had experiences with such technology which proved to be unsatisfactory. The system may not have been appropriate for the needs of the organization, considerable design flaws may have existed, ineffective implementation procedures may have been followed, or the system

may have frequently malfunctioned. For these and many other possible reasons, a person may indicate anxiety or apprehension about man-machine systems. Certainly, a less than positive attitude would be reflected. Such a collection of possible intervening variables may obscure or completely override any existing relationship with the user's psychological type.

The teachers in School A illustrate a group operating in an environment where a CMI system has been successfully implemented with few negative side effects. It may be hypothesized that this represents the most appropriate group for studying relationships between attitudes toward man-machine systems and psychological type. The theoretical framework, therefore, may be best operationalized and subjected to test in an environment in which such intervening variables as negative previous experiences do not obscure the relationships. For reasons explained in the description of the schools in Chapter II, the other pilot test sites were, possibly, environments in which such negative experiences led to misleading data.

The limitations imposed by the sample size prevented any inferences beyond broad speculation. However, the significant relationship at School A clearly indicated the possibility of similar relationships elsewhere.

Detection of such relationships will require the development of an instrument sensitive enough to a well-defined

construct related to apprehension of man-machine systems in order for accurate measurement to be possible. This instrument must also sufficiently filter the inference created by the extraneous variables related to isolated personal experiences.

In summary, Hypothesis I was accepted (i.e., no relationship existed) due to lack of significant relationships in the sample. This acceptance was accompanied by the suggestion that such a relationship may have existed as predicted by the theoretical framework, but went undetected due to insensitivity of the instrument and effects of intervening variables. This suggestion was based on the observation of significant relationships within the School A data set.

Hypothesis II. The statement of this hypothesis was as follows:

> There is no significant relationship between the psychological type of the WIS-SIM user and the user's confidence in WIS-SIM.

This hypothesis was analyzed in a statistical manner similar to the preceding hypothesis, leading to the following findings.

- The analysis of the complete data set obtained from respondents in WIS-SIM pilot test schools led to the acceptance of Hypothesis II (i.e., no significant relationships were observed between psychological type and confidence in the system).

- Although no relationships could be established from the analysis of the total data set, it was possible to establish significant relationships in the School A and School B data. Statistically significant relationships between the extraversion/introversion and thinking/feeling indices and confidence were indicated in the School A data and between the sensation/intuition index and confidence in the School B data.
- The direction of the relationship in the School A set suggests that confidence is associated with extraversion and a thinking preference while the School B set indicated confidence associated with a sensing preference.
- The use of a dummy variable in the regression model took account of the fact that the data were derived from multiple sources and confirmed the deterministic effect of the source.

The obvious question raised by the analysis of this data concerns the parameter which determines confidence in the system. Was confidence a function of psychological type or some other variable or variables associated with the operating environment?

The mean responses to the questionnaire addressing confidence in WIS-SIM indicated a clear disparity between

School A and School B (6.20 at School A vs. 3.79 at School B). These differences were explained in two ways:

(a) Some implementation difficulty was encountered in School B in the fall of 1977 (prior to the survey) due to reorganization of district personnel, extensive student transfers coupled with slow record transmittal, and reductions in the WIS-SIM project staff. Many staff members at School B interpreted this delay in implementation as a defect in the WIS-SIM system rather than the result of multiple problems--primarily within the school and school district itself. In short, the system was possibly a scapegoat for school and school district difficulties.

(b) School A had just implemented the new and more powerful Unified WIS-SIM system which contained many enhancements over the previous system. The faculty's response may have been influenced by this event. Also, the general attitude at School A has, historically, been positive toward CMI.

The existence of such a wide variance in confidence in the system prevented a productive analysis of the total data set. Therefore, the logical analytical approach appeared to be utilization of the individual school data sets; confidence, being directly influenced by local parameters, did not appear

measurable as a function of psychological type in a total data sample. This suggested more credibility be given the respective data sets.

Although research practices would not permit the rejection of Hypothesis II (i.e., indicating the existence of the predicted relationships), it was the opinion of the author that the predicted relationships did exist but were masked by the effect of intervening variables. Therefore, if one were to consider the subsets of the total sample, the hypothesis would not be accepted.

Hypothesis III. Hypothesis III was stated as follows:

> There is no significant relationship between the psychological type of the WIS-SIM user and the user's perception of WIS-SIM's usefulness as an instructional decision support system.

The data gathered to test this hypothesis were analyzed in a manner similar to the data related to the first two hypotheses. "Usefulness" of a MIS was a particularly interesting construct to study as it related to perceptions of system capabilities. These capabilities included diagnosis of student needs, selection of instructional alternatives, reporting of student progress, enhancement of time usage effectiveness, and reduction of clerical tasks.

Because a MIS such as WIS-SIM processes quantified data in a logical and analytical manner to produce objective reports

and instructional recommendations, it was posited that certain psychological types would find this information useful while others would find no value in the system as a decision support device for instructional management. Specifically, the theoretical framework suggested that extraverted thinking types would find the system most useful.

These types (ESTJ and ENTJ) have great respect for impersonal truth, thought-out plans, and orderly efficiency. They tend to be analytic, impersonal, and objectively critical and are not likely to be convinced by anything except reasoning. They organize facts in an effort to reach carefully planned objectives on schedule (Myers, 1962, p. A-1).

The findings derived from the tests of Hypothesis III are given below.

- Analysis of the total data set revealed a significant correlation between the extraversion/introversion index of type and perception of WIS-SIM usefulness. The direction of this correlation indicated that extraverts perceived the system as useful, which was consistent with the theoretical framework.
- Analysis of the School A data set as a separate group indicated a significant relationship between the sensation/intuition and thinking/feeling type indices and perception of usefulness. The direction of the

correlations confirmed the hypothesis that sensation/thinking type perceive the system as useful. This also was consistent with the theory.

Hypothesis IV. This hypothesis was presented as follows:

> There is no significant relationship between the psychological type of the WIS-SIM user and the level of system usage.

This relationship between level of usage of the MIS and psychological type was suggested by the conceptual framework. The user who is a sensation/thinking type was posited to be more receptive and amenable to the CMI system than other type combinations and, consequently, a more frequent user.

The collection of appropriate data to adequately address this hypothesis was not possible. As discussed in Chapter III, it was determined that, due to the organizational structure of the IGE school, CMI report requests originate from groups of persons (i.e., instructional units) rather than specific individuals. The measures of psychological types utilized in this study did not permit inferences about group type. Therefore, no statistical conclusions or inferences concerning this hypothesis were possible.

Ancillary Findings

Three ancillary questions of a heuristic nature were raised in addition to the four principal hypotheses. The first

two concerned the relationship between psychological type and the success or failure of the WIS-SIM implementation effort. Success, in this context, was defined as the desire by the user (school) to continue using WIS-SIM. Failure referred to the user's election to terminate usage of the system.

School A and School B were classified as successful while the Schools C, D, and E were defined as unsuccessful. Measures of eight variables (four indices of type, apprehension toward man-machine systems, confidence in WIS-SIM, perception of usefulness, and perceived adequacy of consultive support) were analyzed using discriminant function analysis.

It was concluded that psychological type did not represent a statistically significant discriminating or classificatory variable. An analysis introducing the entire set of eight variables did, however, indicate the model provided sufficient classificatory information. The variables representing measures of confidence in WIS-SIM and perception of consultive support introduced the highest degree of discrimination between the two successful and unsuccessful users.

The final ancillary question concerned the distribution of teachers according to psychological type in the WIS-SIM user schools as compared with distribution of IGE elementary teachers in non-CMI schools. The base for comparison (i.e.,

distribution of non-CMI teachers) was derived from a random sample of 65 teachers from five elementary schools.

The populations of the WIS-SIM schools were compared with the non-CMI school base through the use of an index representing the comparative frequency of the 16 types in the samples. Another method used was a contingency table and application of the chi-square statistic or the Fisher Exact Probability Test.

The analysis of these data produced the following information:

- The population distribution of School A indicated the existence of a significantly different percentage of extraverts. As discussed earlier, the conceptual framework suggested that extraverts would be more amenable to the capabilities of a MIS such as WIS-SIM than introverts. These findings were certainly consistent with the evidence that School A had been, and continues to be, the most frequent and extensive user of the CMI system.
- The data from School A also revealed a significantly greater percentage of ES and EJ types. The presence of these types provided additional support for the theory.

- The distributions within the remaining WIS-SIM pilot test schools did not differ significantly from the base.

Conclusions

Given the findings of this investigation, the following conclusions were drawn with respect to the relationships between psychological types of users of WIS-SIM and factors associated with the implementation and utilization of the system.

1. Although analysis of the total data set produced no conclusive findings regarding the posited relationships between psychological type and apprehension of man-machine systems, the School A data did provide an indication that such relationships may exist. Unfortunately, the overall construct "apprehension of man-machine systems" is difficult to quantify. Certainly it includes one's attitudes and personal feelings toward the interface between people and technology and one's perceptions (i.e., judgements, understanding, and awareness). The complexities associated with the measurement of any one such parameter are myriad.

2. The School A data may have represented the most accurate measurements of the relationship between psychological type and apprehension of man-machine systems due to the respondents' extensive experience with applications of such technology to education. If this were the case, the findings clearly indicated the existence of a relationship conforming to that posited by the theoretical framework.
3. The measures of confidence in WIS-SIM obtained from the respondents appeared to be a function of the success of implementation in the respective schools in addition to a function of psychological type. Confidence, therefore, became an attitude on the part of the user as well as a reflection of the user's preferences.
4. Based on the School A data, extraverted thinking types reflected the most confidence in WIS-SIM. This was completely consistent with the theory.
5. Findings and conclusions regarding the relationships between the WIS-SIM user's psychological type and his or her perception of WIS-SIM usefulness are perhaps the most valid conclusions presented in the study. This validity was the consequence of two factors:

(a) the construct "usefulness of WIS-SIM" was not laden with problems associated with implementation as in the case of confidence of the system. It was felt that respondents indicated accurate perceptions of usefulness assuming the system functioned in accordance with design specifications;

(b) the reliability of the instrument measuring usefulness was quite high.

6. The finding that a significant relationship existed between extraverts and perceived usefulness of the system was completely consistent with the theoretical framework. According to Jung's typology, the extraverted person thinks, feels, and acts as in direct correspondence with objective conditions (i.e., the objective rather than the subjective is the greater determining factor of the consciousness).

7. The findings associated with Ancillary Questions I and II led to the conclusion that, with respect to this sample, psychological type was not a discriminator between successful and unsuccessful WIS-SIM implementations. The primary determinants of success and/or failure appeared to be confidence in the system and perception of consultive support. The latter

factor, perception of consultive support, may not be a completely reasonable construct to include as a determinant for success or failure for the following reason: the level of the sites' perception of consultive support was used as a proxy measure of actual level of consultive support since this cannot be documented through measures such as number of site visitations, percent of project resources per site, or man-hours per site.

8. With regard to Ancillary Question III regarding distribution comparisons of psychological types between samples, it was concluded that the disproportionate frequency of extraverts in School A accounted for much of the system utilization and internalization.

Implications for Future Research and Development

An implicit motivation for pursuing research as reported in this study was a concern regarding the absence of information related to the interface between users of a management information system and the system itself, including the overall technology as well as the decision support it provides. It has been suggested that the absence of this information has contributed to problems associated with MIS design, implementation, and utilization (Mason & Mitroff, 1973). The thesis of

this study was that the concept of a MIS, specifically the WIS-SIM computer managed instruction system, should incorporate the personality or psychological typology of the user into the design.

The findings of this study revealed that at least a significant portion of the wide variance in WIS-SIM implementation success might be attributable to psychological type. This was evidenced by correlations between perceived usefulness and confidence and the user's personality type, as well as the implications of the type distributions among the schools. Although not all the relationships were statistically significant, they did indicate directions consistent with the theoretical framework.

The general conceptual framework, design, and findings of this led to considerations which should be given in future related research as given below:

1. The constructs identified for research in this study (apprehension of man-machine systems, confidence in WIS-SIM, and usefulness of WIS-SIM) may not be the most appropriate for unravelling the relationships hypothesized between a person of a certain psychological type and an information system. Analysis of the data in this study coupled with interviews with selected respondents indicated the measures of

these phenomena were highly influenced by their experiences with applications of computer technology.

2. At least two questions related to the issues raised remain unanswered:
   a. Does the teacher or instructional manager have preferences or biases for or against analytic/logical decision-making as a function of his or her psychological type regardless of the decision support system (e.g., electronic or conventional)?
   b. Are certain levels of information preferred by teachers in the context of open-ended decision-making situations? For example, in the instructional grouping process, data at one level might consist of quantitative profiles of each student. At another level, a total grouping recommendation might be supplied, complete with suggested lesson plans, tests, etc. Are varying levels of preferred information a function of psychological type?
3. Does a relationship exist between psychological type and the method of evidence generation? For the teacher, evidence is the information upon which instructional decisions will be based. Certainly some reliance will be placed on some methods of

generating evidence as opposed to others because of the securities of these methods (i.e., the information is correct or stronger). The theoretical development of a research strategy from which this topic may be approached is philosophical and epistemological. Considerable work is beginning in MIS theory related to inquiring systems but more research is clearly required (Mason & Mitroff, 1973, p. 480). Churchman (1971) identified five models of evidence generators for any problem. Although it is beyond the scope and purpose of this section to present a discussion of these inquiring systems, the five inquiring systems include the Lockean, Leibnitzian, Kantian, Hegelian, and Singerian-Churchmanian systems. The design of most MIS to data have been undertaken from the viewpoint of Leibnitzian and Lockean inquiry, neglecting the other bases (Mason & Mitroff, 1973, p. 483).

4. An initial limitation of the study was the absence of well-developed and time-tested instruments to measure the constructs of interest. Until methodologies are developed, capable of providing quantitative expressions of qualitative properties, definitive conclusions

will be impossible. The need for such an effort is clear and may well constitute an extended investigation in itself.

5. The total implications of psychological type are far from clear, particularly as related to management science, information, inquiry, and decision making. Although some research is taking place in this area, insufficient information is currently available.
6. It appears certain that development will continue in the field of computer-supported management information systems in education. This development must be based upon a sound conceptual framework embracing personality theory, problem types (structured and unstructured), types of inquiring systems and evidence generators, decision theory, and organizational theory. Without this foundation, developmental efforts will be unsound, resulting in unsuccessful implementation.

In summary, this study reinforced the need for planned research and theory related to the management of information. Too little is presently available as a foundation for the understanding of complex decision making. Without such a theory, developmental efforts in the design of MIS will be inadequate, as evidenced by the high failure rate of MIS

implementations in both education and industry. Comprehensive research must be based on a sound epistemological framework within a total systems concept for the purpose of providing a complete conceptual structure.

BIBLIOGRAPHY

Adams, J. Mack and Haden, Douglas H. Social Effects of Computer Use and Misuse. New York: John Wiley and Sons, 1976.

Amick, Daniel J. and Walberg, Herbert J. (Eds.). Introductory Multivariate Analysis. Berkeley: McCutchan Publishing Co., 1975.

Anastasi, A. Psychological Testing. New York: McMillan Co., 1954.

Anthony, Robert. "Planning and Control Systems: A Framework for Analysis." In R. O. Mason and I. I. Mitroff. "A Program for Research on Management Information Systems." Management Science 19 (January 1973): 473-487.

Awad, Elias M. Business Data Processing. Englewood Cliffs: Prentice-Hall, 1968.

Argyris, Chris. "Management Information Systems: The Challenge to Rationality and Emotionality." Management Science 17 (February 1971): 275-292.

Baker, Frank B. Computer Managed Instruction: Theory and Practice. Englewood Cliffs: Educational Technology Publications, 1978.

Belt, S. L. and Spuck, D. W. Design Specifications for the Generalized Wisconsin System for Instructional Management. Working Paper No. 133. Madison: Wisconsin Research and Development Center for Cognitive Learning, 1975.

Bennet, E. A. What Jung Really Said. London: Macdonald and Co., 1966.

Bradway, K. "Psychological Types: Classification by Test Versus Classification by Self." Journal of Analytical Psychology 9 (1964): 129-135.

Buros, O. K. Personality Tests and Reviews. Highland Park, N. J., 1970.

Carlyn, Marcia. "An Assessment of the Myers-Briggs Type Indicator." Journal of Personality Assessment 41 (May 1977): 461-473.

Chervany, Norman L. and Dickson, Gary W. "An Experiment Evaluation of Information Overload in a Production Environment." Management Science 20 (June 1974): 1335-1344.

Churchman, C. West. The Design of Inquiring Systems. New York: Basic Books, 1971.

Couger, J. Daniel. "Evaluation of Business Systems Analysis Techniques." Computing Surveys 3 (September 1973): 167-197.

Cunningham, William G. "The Need for Dialogue Between Educators and Technologists." Phi Delta Kappan 58 (February 1977): 462.

Diebold Group, Inc. (Ed.). Automatic Data Processing. New York: McGraw-Hill, 1977.

Douglas, Bruce G.; Belt, S. L.; Owen, S. P.; and Chan, Nancy. System Design Manual for the Unified Wisconsin System of Instructional Management. Unpublished paper. Madison: Wisconsin Research and Development Center for Cognitive Learning, 1977.

Draper, N. R. and Smith, H. Applied Regression Analysis. New York: John Wiley and Sons, Inc., 1966.

Drucker, Peter. "The Effective Executive." World Press (1962).

Edwards, Allen L. Techniques of Attitude Scale Construction. New York: Appleton-Century-Crofts, Inc., 1957.

Gulick, Luther and Urwick, L. (Eds.). "Papers on the Science of Administration." In Jacob W. Getzels, James M. Lipham, and Roald F. Campbell. Educational Administration as a Social Process. New York: Harper and Row, 1968.

Harrison, Howard L. "Systems Analysis for Social-Science Professionals." Madison: University of Wisconsin, 1977. (Mimeographed.)

Hawkes, Nigel. The Computer Revolution. London: Thames and Hudson Ltd., 1971.

Hayes, William L. Statistics for the Social Sciences. New York: Holt, Rinehart, and Winston, Inc., 1973.

Hoos, Ida R. "Information Systems and Public Planning." Management Science 10 (June 1971).

IGE Implementor's Manual. Madison: Wisconsin Research and Development Center for Cognitive Learning, 1975.

Isaac, Stephen and Michael, William B. Handbook in Research and Evaluation. San Diego: Robert R. Knapp, 1971.

Jung, C. G. Psychological Types. New York: Harcourt, Brace, and Co., 1923.

Jung, C. G. Contributions to Analytical Psychology. New York: Harcourt, Brace, and Co., 1928.

Kanter, Jerome. Management-Oriented Management Information Systems. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1977.

Kerlinger, F. N. Foundations of Behavioral Research (2nd Ed.). New York: Holt, Rinehart, and Winston, Inc., 1973.

Khandwalla, Pradip N. "Mass Output Orientation of Operations Technology and Organizational Structure." Administrative Science Quarterly 19 (March 1974): 74-97.

Kilmann, Ralph H. and Taylor, Vern. "A Contingency Approach to Laboratory Learning: Psychological Types Versus Experimental Norms." Human Relations 27 (December 1973): 891-909.

Klausmeier, H. J.; Quilling, M. R.; Sorenson, J. S.; and Glasrud, G. R. Individually Guided Education: Guidelines for Implementation. Madison: Wisconsin Research and Development Center for Cognitive Learning, 1971.

Kneitel, Arnold M. "Hard Information Versus Soft Information for Decision Making Managers." Management Datamatics 5 (March 1976): 95-99.

Lehmann, I. J., and Mehrens, W. A. (Eds.). Educational Research Readings in Focus. New York: Holt, Rinehart, and Winston, Inc., 1971.

London, Keith. The People Side of Systems. London: McGraw-Hill Co., 1976.

Loughary, John W. Man-Machine Systems in Education. New York: Harper and Row, 1966.

Lundeberg, Mats. Information Analysis. Stockholm: Royal Institute of Technology, 1970.

Maslow, Abraham. The Psychology of Science. New York: Harper and Row, 1966.

Mason, R. O. and Mitroff, I. I. "A Program for Research on Management Information Systems." Management Science 19 (January 1973): 473-487.

McCaulley, Mary H. "Psychological Types in Engineering: Implications for Teaching." Engineering Education (April 1976): 729-736.

McCaulley, Mary H. Understanding the Type Table. Gainesville, Florida: Center for the Applications of Psychological Type, 1976.

Mendelsohn, Gerald A. "Review of the Myers-Briggs Type Indicator." In O. K. Buros (Ed.). Sixth Mental Measurements Yearbook. Highland Park, New Jersey: Gryphen Press, 1965.

Mitroff, Ian I. "Fundamental Issues in the Simulation of Human Behavior: A Case in the Strategy of Behavioral Science." Management Science 15 (August 1969): 635-649.

Mitroff, Ian I., Nelson, John, and Mason, Richard O. "On Management Myth-Information Systems." Management Science 21 (December, 1974): 371-382.

Mitroff, Ian I. "On Evaluating Scientific Research: The Contribution of the Psychology of Science." University of Pittsburgh, 1974. (Mimeographed.)

Mitroff, Ian I. "On the Importance of Qualitative Analysis in Management Science: The Influence of Personality Variables on Organizational Decision-Making." University of Pittsburgh, 1974. (Mimeographed.)

Morrison, Donald F. Multivariate Statistical Methods. New York: McGraw-Hill Co., 1976.

Mumford, Enid and Banks, Olive. The Computer and the Clerk. London: Routledge and Kegan Paul, 1967.

Myers, Isabel Briggs. Myers-Briggs Type Indicator Manual. Palo Alto, California: Consulting Psychologists Press, Inc., 1962.

Nadler, Gerald. Work Design. Homewood: Richard D. Irwin, 1970.

Nelson, Larry Richard. Guide to LERTAP Use and Interpretation. Dunedin, New Zealand: University of Otago, 1974.

Noyce, Robert N. "Microelectronics." Scientific American 237 (September 1977): 62-69.

Optner, Stanford L. (Ed.). Systems Analysis. Baltimore: Penguin Books, 1973.

Peace, David M. S. and Easterby, Ronald S. "The Evaluation of User Interaction with Computer-Based Management Information Systems." Human Factors 13 (April 1973): 163-177.

Sanathanan, Lalitha. "Discriminant Analysis." In Daniel J. Amick and Herbert J. Walberg (Eds.). Introductory Multivariate Analysis. Berkely: McCutchan Publishing Co., 1975.

Shepherd, Jon M. Automation and Alienation. Cambridge, Massachusetts: MIT Press, 1971.

Siegal, Laurence. Industrial Psychology. Homewood, Illinois: Richard D. Irwin, Inc., 1969.

Sippl, Charles J. Microcomputer Handbook. New York: Petrocelli/ Charter, 1977.

Spencer, Donald D. Computers in Society. Rochelle Park, New Jersey: Hayden Book Co., 1974.

Spuck, Dennis W.; Bozeman, William C.; and Lawrence, Brian F. Evaluation of the Wisconsin System for Instructional Management. Technical Report No. 438. Madison: Wisconsin Research and Development Center for Cognitive Learning, 1977.

Spuck, Dennis W.; Hunter, S. N.; Owen, S. P.; and Belt, S. L. Computer Management of Individualized Instruction. Theoretical Paper No. 55. Madison: Wisconsin Research and Development Center for Cognitive Learning, 1975.

Stanley, J. C. and Hopkins, K. D. Educational and Psychological Measurement and Evaluation. Englewood Cliffs: Prentice-Hall, 1972.

Sterling, Theodor D. and Landon, Kenneth. "Humanizing Information Systems." Datamation 22 (December 1976): 53-59.

Storr, Anthony. Jung. London: Wm. Collins Sons and Co. Ltd., 1973.

Sundberg, Norman D. "Review of the Myers-Briggs Type Indicator." In O. K. Buros (Ed.). Sixth Mental Measurements Yearbook. Highland Park, New Jersey: Gryphen Press, 1965.

Swanson, Burton E. "Management Information Systems: Appreciation and Involvement." Management Science 21 (October 1974): 178-188.

Tofler, Alvin. Future Shock. New York: Random House, Inc., 1970.

Van Dalen, Deobold B. Understanding Educational Research. New York: McGraw-Hill Co., 1966.

APPENDIX A

MYERS-BRIGGS TYPE INDICATOR

MYERS-BRIGGS TYPE INDICATOR

FORM F

by Katharine C. Briggs and Isabel Briggs Myers

DIRECTIONS:

There are no "right" or "wrong" answers to these questions. Your answers will help show how you like to look at things and how you like to go about deciding things. Knowing your own preferences and learning about other people's can help you understand where your special strengths are, what kinds of work you might enjoy and be successful doing, and how people with different preferences can relate to each other and be valuable to society.

Read each question carefully and mark your answer on the separate answer sheet. *Make no marks on the question booklet.* Do not think too long about any question. If you cannot decide on a question, skip it but be careful that the *next* space you mark on the answer sheet has the same number as the question you are then answering.

Read the directions on your answer sheet, fill in your name and any other facts asked for, and work through until you have answered all the questions.

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Which answer comes closest to telling how you usually feel or act?

1. Does following a schedule
   (A) appeal to you, or
   (B) cramp you?

2. Do you usually get along better with
   (A) imaginative people, or
   (B) realistic people?

3. If strangers are staring at you in a crowd, do you
   (A) often become aware of it, or
   (B) seldom notice it?

4. Are you more careful about
   (A) people's feelings, or
   (B) their rights?

5. Are you
   (A) inclined to enjoy deciding things, or
   (B) just as glad to have circumstances decide a matter for you?

6. When you are with a group of people, would you usually rather
   (A) join in the talk of the group, or
   (B) talk individually with people you know well?

7. When you have more knowledge or skill in something than the people around you, is it more satisfying
   (A) to guard your superior knowledge, or
   (B) to share it with those who want to learn?

8. When you have done all you can to remedy a troublesome situation, are you
   (A) able to stop worrying about it, or
   (B) still more or less haunted by it?

9. If you were asked on a Saturday morning what you were going to do that day, would you
   (A) be able to tell pretty well, or
   (B) list twice too many things, or
   (C) have to wait and see?

10. Do you think on the whole that
    (A) children have the best of it, or
    (B) life is more interesting for grown-ups?

11. In doing something that many other people do, does it appeal to you more to
    (A) do it in the accepted way, or
    (B) invent a way of your own?

12. When you were small, did you
    (A) feel sure of your parents' love and devotion to you, or
    (B) feel that they admired and approved of some other child more than they did of you?

13. Do you
    (A) rather prefer to do things at the last minute, or
    (B) find that hard on the nerves?

14. If a breakdown or mix-up halted a job on which you and a lot of others were working, would your impulse be to
    (A) enjoy the breathing spell, or
    (B) look for some part of the work where you could still make progress, or
    (C) join the "trouble-shooters" who were wrestling with the difficulty?

15. Do you usually
    (A) show your feelings freely, or
    (B) keep your feelings to yourself?

16. When you have decided upon a course of action, do you
    (A) reconsider it if unforeseen disadvantages are pointed out to you, or
    (B) usually put it through to a finish, however it may inconvenience yourself and others?

17. In reading for pleasure, do you
    (A) enjoy odd or original ways of saying things, or
    (B) like writers to say exactly what they mean?

18. In any of the ordinary emergencies of everyday life, do you prefer to
    (A) take orders and be helpful, or
    (B) give orders and be responsible?

19. At parties, do you
    (A) sometimes get bored, or
    (B) always have fun?

20. Is it harder for you to adapt to
    (A) routine, or
    (B) constant change?

21. Would you be more willing to take on a heavy load of extra work for the sake of
    (A) extra comforts and luxuries, or
    (B) a chance to achieve something important?

22. Are the things you plan or undertake
    (A) almost always things you can finish, or
    (B) often things that prove too difficult to carry through?

23. Are you more attracted to
    (A) a person with a quick and brilliant mind, or
    (B) a practical person with a lot of common sense?

24. Do you find people in general
    (A) slow to appreciate and accept ideas not their own, or
    (B) reasonably open-minded?

25. When you have to meet strangers, do you find it
    (A) pleasant, or at least easy, or
    (B) something that takes a good deal of effort?

26. Are you inclined to
    (A) value sentiment more than logic, or
    (B) value logic more than sentiment?

27. Do you prefer to
    (A) arrange dates, parties, etc. well in advance, or
    (B) be free to do whatever looks like fun when the time comes?

28. In making plans which concern other people, do you prefer to
    (A) take them into your confidence, or
    (B) keep them in the dark until the last possible moment?

29. Is it a higher compliment to be called
    (A) a person of real feeling, or
    (B) a consistently reasonable person?

30. When you have a decision to make, do you usually
    (A) make it right away, or
    (B) wait as long as you reasonably can *before deciding*?

31. When you run into an unexpected difficulty in something you are doing, do you feel it to be
    (A) a piece of bad luck, or
    (B) a nuisance, or
    (C) all in the day's work?

32. Do you almost always
    (A) enjoy the present moment and make the most of it, or
    (B) feel that something just ahead is more important?

33. Are you
    (A) easy to get to know, or
    (B) hard to get to know?

34. With most of the people you know, do you
    (A) feel that they mean what they say, or
    (B) feel you must watch for a hidden meaning?

35. When you start a big project that is due in a week, do you
    (A) take time to list the separate things to be done and the order of doing them, or
    (B) plunge in?

36. In solving a personal problem, do you
    (A) feel more confident about it if you have asked other people's advice, or
    (B) feel that nobody else is in as good a position to judge as you are?

37. Do you admire more the people who are
    (A) conventional enough never to make themselves conspicuous, or
    (B) too original and individual to care whether they are conspicuous or not?

38. Which mistake would be more natural for you:
    (A) to drift from one thing to another all your life, or
    (B) to stay in a rut that didn't suit you?

Go on to the next page.

39. When you run across people who are mistaken in their beliefs, do you feel that
    (A) it is your duty to set them right, or
    (B) it is their privilege to be wrong?

40. When an attractive chance for leadership comes to you, do you
    (A) accept it if it is something you can really swing, or
    (B) sometimes let it slip because you are too modest about your own abilities,
    (C) or doesn't leadership ever attract you?

41. Among your friends, are you
    (A) one of the last to hear what is going on, or
    (B) full of news about everybody?

42. Are you at your best
    (A) when dealing with the unexpected, or
    (B) when following a carefully worked-out plan?

43. Does the importance of doing well on a test make it generally
    (A) easier for you to concentrate and do your best, or
    (B) harder for you to concentrate and do yourself justice?

44. In your free hours, do you
    (A) very much enjoy stopping somewhere for refreshments, or
    (B) usually want to use the time and money another way?

45. At the time in your life when things piled up on you the worst, did you find
    (A) that you had gotten into an impossible situation, or
    (B) that by doing only the necessary things you could work your way out?

46. Do most of the people you know
    (A) take their fair share of praise and blame, or
    (B) grab all the credit they can but shift any blame on to someone else?

47. When you are in an embarrassing spot, do you usually
    (A) change the subject, or
    (B) turn it into a joke, or
    (C) days later, think of what you should have said?

48. Are such emotional "ups and downs" as you may feel
    (A) very marked, or
    (B) rather moderate?

49. Do you think that having a daily routine is
    (A) a comfortable way to get things done, or
    (B) painful even when necessary?

50. Are you usually
    (A) a "good mixer", or
    (B) rather quiet and reserved?

51. In your early childhood (at six or eight), did you
    (A) feel your parents were very wise people who should be obeyed, or
    (B) find their authority irksome and escape it when possible?

52. When you have a suggestion that ought to be made at a meeting, do you
    (A) stand up and make it as a matter of course, or
    (B) hesitate to do so?

53. Do you get more annoyed at
    (A) fancy theories, or
    (B) people who don't like theories?

54. When you are helping in a group undertaking, are you more often struck by
    (A) the cooperation, or
    (B) the inefficiency,
    (C) or don't you get involved in group undertakings?

55. When you go somewhere for the day, would you rather
    (A) plan what you will do and when, or
    (B) just go?

56. Are the things you worry about
    (A) often really not worth it, or
    (B) always more or less serious?

57. In deciding something important, do you
    (A) find you can trust your feeling about what is best to do, or
    (B) think you should do the *logical* thing, no matter how you feel about it?

58. Do you tend to have
(A) deep friendships with a very few people, or
(B) broad friendships with many different people?

59. Do you think your friends
(A) feel you are open to suggestions, or
(B) know better than to try to talk you out of anything you've decided to do?

60. Does the idea of making a list of what you should get done over a week-end
(A) appeal to you, or
(B) leave you cold, or
(C) positively depress you?

61. In traveling, would you rather go
(A) with a companion who had made the trip before and "knew the ropes", or
(B) alone or with someone greener at it than yourself?

62. Would you rather have
(A) an opportunity that may lead to bigger things, or
(B) an experience that you are sure to enjoy?

63. Among your personal beliefs, are there
(A) some things that cannot be proved, or
(B) only things than *can* be proved?

64. Would you rather
(A) support the established methods of doing good, or
(B) analyze what is still wrong and attack unsolved problems?

65. Has it been your experience that you
(A) often fall in love with a notion or project that turns out to be a disappointment so that you "go up like a rocket and come down like the stick", or do you
(B) use enough judgment on your enthusiasms so that they do not let you down?

66. Do you think you get
(A) more enthusiastic about things than the average person, or
(B) less enthusiastic about things than the average person?

67. If you divided all the people you know into those you like, those you dislike, and those toward whom you feel indifferent, would there be more of
(A) those you like, or
(B) those you dislike?

[On this next question *only*, if two answers are true, mark both.]

68. In your daily work, do you
(A) rather enjoy an emergency that makes you work against time, or
(B) hate to work under pressure, or
(C) usually plan your work so you won't *need* to work under pressure?

69. Are you more likely to speak up in
(A) praise, or
(B) blame?

70. Is it higher praise to say someone has
(A) vision, or
(B) common sense?

71. When playing cards, do you enjoy most
(A) the sociability,
(B) the excitement of winning,
(C) the problem of getting the most out of each hand,
(D) the risk of playing for stakes,
(E) or don't you enjoy playing cards?

Go on to the next page.

Which word in each pair appeals to you more?

72.	(A) firm-minded	warm-hearted	(B)
73.	(A) imaginative	matter-of-fact	(B)
74.	(A) systematic	spontaneous	(B)
75.	(A) congenial	effective	(B)
76.	(A) theory	certainty	(B)
77.	(A) party	theater	(B)
78.	(A) build	invent	(B)
79.	(A) analyze	sympathize	(B)
80.	(A) popular	intimate	(B)
81.	(A) benefits	blessings	(B)
82.	(A) casual	correct	(B)
83.	(A) active	intellectual	(B)
84.	(A) uncritical	critical	(B)
85.	(A) scheduled	unplanned	(B)
86.	(A) convincing	touching	(B)
87.	(A) reserved	talkative	(B)
88.	(A) statement	concept	(B)
89.	(A) soft	hard	(B)
90.	(A) production	design	(B)
91.	(A) forgive	tolerate	(B)
92.	(A) hearty	quiet	(B)
93.	(A) who	what	(B)
94.	(A) impulse	decision	(B)
95.	(A) speak	write	(B)
96.	(A) affection	tenderness	(B)
97.	(A) punctual	leisurely	(B)
98.	(A) sensible	fascinating	(B)
99.	(A) changing	permanent	(B)
100.	(A) determined	devoted	(B)
101.	(A) system	zest	(B)
102.	(A) facts	ideas	(B)
103.	(A) compassion	foresight	(B)
104.	(A) concrete	abstract	(B)
105.	(A) justice	mercy	(B)
106.	(A) calm	lively	(B)
107.	(A) make	create	(B)
108.	(A) wary	trustful	(B)
109.	(A) orderly	easy-going	(B)
110.	(A) approve	question	(B)
111.	(A) gentle	firm	(B)
112.	(A) foundation	spire	(B)
113.	(A) quick	careful	(B)
114.	(A) thinking	feeling	(B)
115.	(A) theory	experience	(B)
116.	(A) sociable	detached	(B)
117.	(A) sign	symbol	(B)
118.	(A) systematic	casual	(B)
119.	(A) literal	figurative	(B)
120.	(A) peacemaker	judge	(B)
121.	(A) accept	change	(B)
122.	(A) agree	discuss	(B)
123.	(A) executive	scholar	(B)

Which answer comes closest to telling how you usually feel or act?

124. Do you find the more routine parts of your day
   (A) restful, or
   (B) boring?

125. If you think you are not getting a square deal in a club or team to which you belong, is it better to
   (A) shut up and take it, or
   (B) use the threat of resigning if necessary to get your rights?

126. Can you
   (A) talk easily to almost anyone for as long as you have to, or
   (B) find a lot to say only to certain people or under certain conditions?

127. When strangers notice you, does it
   (A) make you uncomfortable, or
   (B) not bother you at all?

128. If you were a teacher, would you rather teach
   (A) fact courses, or
   (B) courses involving theory?

129. When something starts to be the fashion, are you usually
   (A) one of the first to try it, or
   (B) not much interested?

130. In solving a difficult personal problem, do you
   (A) tend to do more worrying than is useful in reaching a decision, or
   (B) feel no more anxiety than the situation requires?

131. If people seem to slight you, do you
   (A) tell yourself they didn't mean anything by it, or
   (B) distrust their good will and stay on guard with them thereafter?

132. When you have a special job to do, do you like to
   (A) organize it carefully before you start, or
   (B) find out what is necessary as you go along?

133. Do you feel it is a worse fault
   (A) to show too much warmth, or
   (B) not to have warmth enough?

134. When you are at a party, do you like to
   (A) help get things going, or
   (B) let the others have fun in their own way?

135. When a new opportunity comes up, do you
   (A) decide about it fairly quickly, or
   (B) sometimes miss out through taking too long to make up your mind?

136. In managing your life, do you tend to
   (A) undertake too much and get into a tight spot, or
   (B) hold yourself down to what you can comfortably handle?

137. When you find yourself definitely in the wrong, would you rather
   (A) admit you are wrong, or
   (B) not admit it, though everyone knows it,
   (C) or don't you ever find yourself in the wrong?

138. Can the new people you meet tell what you are interested in
   (A) right away, or
   (B) only after they really get to know you?

139. In your home life, when you come to the end of some undertaking, are you
   (A) clear as to what comes next and ready to tackle it, or
   (B) glad to relax until the next inspiration hits you?

140. Do you think it more important to
   (A) be able to see the possibilities in a situation, or
   (B) be able to adjust to the facts as they are?

141. Do you feel that the people whom you know personally owe their successes more to
   (A) ability and hard work, or
   (B) luck, or
   (C) bluff, pull and shoving themselves ahead of others?

142. In getting a job done, do you depend upon
   (A) starting early, so as to finish with time to spare, or
   (B) the extra speed you develop at the last minute?

143. After associating with superstitious people, have you
   (A) found yourself slightly affected by their superstitions, or
   (B) remained entirely unaffected?

Go on to the next page.

144. When you don't agree with what has just been said, do you usually
(A) let it go, or
(B) put up an argument?

145. Would you rather be considered
(A) a practical person, or
(B) an ingenious person?

146. Out of all the good resolutions you may have made, are there
(A) some you have kept to this day, or
(B) none that have really lasted?

147. Would you rather work under someone who is
(A) always kind, or
(B) always fair?

148. In a large group, do you more often
(A) introduce others, or
(B) get introduced?

149. Would you rather have as a friend someone who
(A) is always coming up with new ideas, or
(B) has both feet on the ground?

150. When you have to do business with strangers, do you feel
(A) confident and at ease, or
(B) a little fussed or afraid that they won't want to bother with you?

151. When it is settled well in advance that you will do a certain thing at a certain time, do you find it
(A) nice to be able to plan accordingly, or
(B) a little unpleasant to be tied down?

152. Do you feel that sarcasm
(A) should never be used where it can hurt people's feelings, or
(B) is too effective a form of speech to be discarded for such a reason?

153. When you think of some little thing you should do or buy, do you
(A) often forget it till much later, or
(B) usually get it down on paper to remind yourself, or
(C) always carry through on it without reminders?

154. Do you more often let
(A) your heart rule your head, or
(B) your head rule your heart?

155. In listening to a new idea, are you more anxious to
(A) find out all about it, or
(B) judge whether it is right or wrong?

156. Are you oppressed by
(A) many different worries, or
(B) comparatively few?

157. When you don't approve of the way a friend is acting, do you
(A) wait and see what happens, or
(B) do or say something about it?

158. Do you feel it is a worse fault to be
(A) unsympathetic, or
(B) unreasonable?

159. When a new situation comes up which conflicts with your plans, do you try first to
(A) change your plans to fit the situation, or
(B) change the situation to fit your plans?

160. Do you think the people close to you know how you feel
(A) about most things, or
(B) only when you have had some special reason to tell them?

161. When you have a serious choice to make, do you
(A) almost always come to a clear-cut decision, or
(B) sometimes find it so hard to decide that you do not wholeheartedly follow up either choice?

162. On most matters, do you
(A) have a pretty definite opinion, or
(B) like to keep an open mind?

163. As you get to know people better, do you more often find that they
(A) let you down or disappoint you in some way, or
(B) improve upon acquaintance?

164. When the truth would not be polite, are you more likely to tell
(A) a polite lie, or
(B) the impolite truth?

165. In your way of living, do you prefer to be
(A) original, or
(B) conventional?

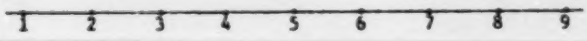
166. Would you have liked to argue the meaning of
(A) a lot of these questions, or
(B) only a few?

APPENDIX B

APPREHENSION OF MAN-MACHINE SYSTEMS QUESTIONNAIRE

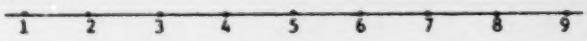
DIRECTIONS: On the scales provided, rate the following statements by circling the number you consider best indicates your agreement or disagreement.

1. Using a computer for record keeping and clerical tasks allows teachers to enhance their professional talents.



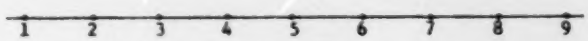
Strongly Disagree | Disagree | No Opinion | Agree | Strongly Agree

2. Use of student achievement data from a computer de-personalizes instructional decision making.



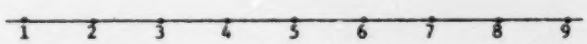
Strongly Disagree | Disagree | No Opinion | Agree | Strongly Agree

3. Job security is not a valid concern when computers are involved in the process of education.



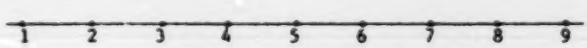
Strongly Disagree | Disagree | No Opinion | Agree | Strongly Agree

4. Assigning students computer identification numbers is de-humanizing.



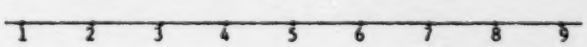
Strongly Disagree | Disagree | No Opinion | Agree | Strongly Agree

5. Computers should be used for information management whenever appropriate in modern society.



Strongly Disagree | Disagree | No Opinion | Agree | Strongly Agree

6. The introduction of computer technology into the classroom creates feelings of anxiety among the professional staff.



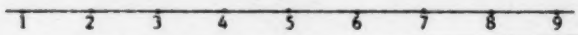
Strongly Disagree | Disagree | No Opinion | Agree | Strongly Agree

APPENDIX C

CONFIDENCE IN WIS-SIM QUESTIONNAIRE

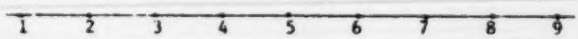
DIRECTIONS: Rate WIS-SIM on the scales provided by circling the number you consider best indicates your agreement or disagreement with the statements below:

1. WIS-SIM is responsive (i.e., information is available when needed).



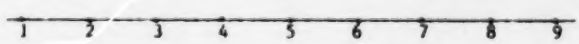
Strongly Disagree | Disagree | No Opinion | Agree | Strongly Agree

2. Student achievement information provided by WIS-SIM is current.



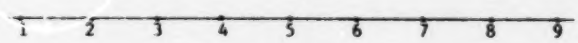
Strongly Disagree | Disagree | No Opinion | Agree | Strongly Agree

3. Student achievement information provided by WIS-SIM is accurate.



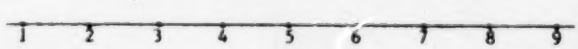
Strongly Disagree | Disagree | No Opinion | Agree | Strongly Agree

4. WIS-SIM instructional grouping recommendations coincide with your personnel professional judgements.



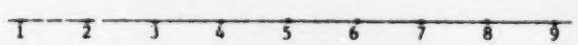
Strongly Disagree | Disagree | No Opinion | Agree | Strongly Agree

5. Student achievement information provided by WIS-SIM is complete.



Strongly Disagree | Disagree | No Opinion | Agree | Strongly Agree

6. I have no reservations about instructional decisions based on WIS-SIM information



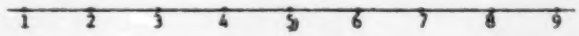
Strongly Disagree | Disagree | No Opinion | Agree | Strongly Agree

APPENDIX D

USEFULNESS OF WIS-SIM QUESTIONNAIRE

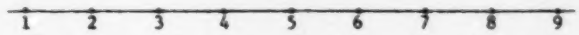
DIRECTIONS: Rate the usefulness of WIS-SIM with respect to each of the ten items below by circling the number on each scale which you consider best indicates your assessment.

1. Diagnosing student needs in a given subject area



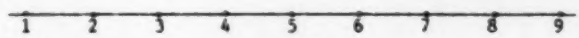
1	2	3	4	5	6	7	8	9
Not Useful At All		Somewhat Useful		Useful		Frequently Useful		Extremely Useful

2. Selecting educational experiences (for example, specific topics or objectives to be taught) for students



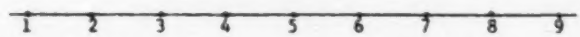
1	2	3	4	5	6	7	8	9
Not Useful At All		Somewhat Useful		Useful		Frequently Useful		Extremely Useful

3. Reporting student progress to parents



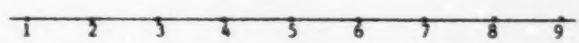
1	2	3	4	5	6	7	8	9
Not Useful At All		Somewhat Useful		Useful		Frequently Useful		Extremely Useful

4. Minimizing time required for clerical tasks



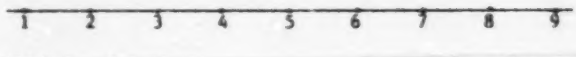
1	2	3	4	5	6	7	8	9
Not Useful At All		Somewhat Useful		Useful		Frequently Useful		Extremely Useful

5. Obtaining information about a student or groups of students

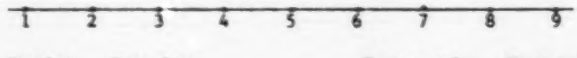


1	2	3	4	5	6	7	8	9
Not Useful At All		Somewhat Useful		Useful		Frequently Useful		Extremely Useful

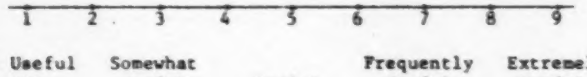
6. Grouping of students for instruction



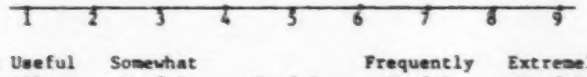
7. Transferring student achievement data from unit to unit, school to school, and/or year to year



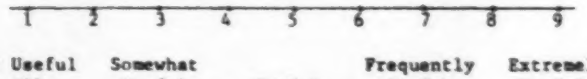
8. Increasing amount of time available for actual instruction of students



9. Decreasing record-keeping tasks



10. Recording of student progress



APPENDIX E

MEMORANDUM TO PARTICIPANTS

the Wisconsin Research and Development Center for Cognitive Learning

the University of Wisconsin · 1025 West Johnson Street · Madison, Wisconsin 53706 · (608) 263-4200

M E M O R A N D U M

TO: Pilot Study Participants

FROM: William C. Bozeman

RE: Computer Managed Instruction Pilot Test

Please find enclosed the following materials:

1. Participant consent form - This form is required in order to comply with DHEW regulations.
2. Participant information sheet
3. Myers-Briggs Type Indicator - This instrument is used to determine attitudes and preferences in decision making. Information will be correlated with other data to provide direction for better serving future CMI users.
4. Answer sheet - Be sure to include name and sex (this is essential in scoring). Age is not necessary.
5. Systems questionnaire - This instrument concerns certain attitudes regarding human-machine systems.

Thank you very much for your time and cooperation.

APPENDIX F

PARTICIPANT CONSENT FORM

The University of Wisconsin, in conformity with DHEW requirements, must obtain the consent of participants associated with research activities. After reading the section below, your signature will indicate your understanding and agreement to participate in this research.

This research is part of the overall effort on the part of the Wisconsin R and D Center to develop an effective and efficient computer managed instruction system for individualizing education. The procedure involved will consist of the completion of two questionnaires--a type or preference indicator and a CMI evaluation instrument.

Complete anonymity will be maintained in the data compilation. The final report will not specify names, teacher numbers, etc. The participant is free to withdraw his or her consent and to discontinue participation in the project at any time.

Any questions or inquiries should be directed to:

Bill Bozeman
Wisconsin R & D Center
1025 W. Johnson Street
Madison, WI 53706

Your time and careful consideration of all the items are appreciated.

_____ _____

Date Participant

APPENDIX G

PARTICIPANT INFORMATION FORM

the Wisconsin Research and Development Center for Cognitive Learning

the University of Wisconsin · 1025 West Johnson Street · Madison, Wisconsin 53706 · (608) 263-4200

COMPUTER APPLICATIONS IN IGE

WIS-SIM PILOT STUDY

INFORMATION SHEET

_____
Name of School

_____
Grade

Number of years teaching experience _____

Highest degree held _____

AGE RANGE

20-26 ☐
27-34 ☐
35-- ☐

SEX

Male ☐

Female ☐

SUBJECT AREA(with regard to academic preparation or teaching assignments)

Language arts ☐
Mathematics ☐
Science ☐
Social Studies ☐
Music ☐
Physical Education ☐

Center Planning and Policy Committee

Richard A. Rossmiller
Wayne Otto
Center Co-Directors

Dale D. Johnson
Area Chairperson
Studies in Reading, Language, and Communication

Marvin J. Fruth
Area Chairperson
Studies of Implementation of Individualized Schooling

Penelope L. Peterson
Area Chairperson
Studies of Instructional Programming for the Individual Student

James M. Lipham
Area Chairperson
Studies of Administration and Organization for Instruction

Thomas A. Romberg
Area Chairperson
Studies in Mathematics and Evaluation of Practices in Individualized Schooling

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Louise J. Cherry
Assistant Professor
Educational Psychology

Fred W. Danner
Assistant Professor
Educational Psychology

William J. Davis
Assistant Professor
Educational Administration

W. Patrick Dickson
Assistant Professor
Child and Family Studies

Lloyd E. Frohreich
Associate Professor
Educational Administration

Marvin J. Fruth
Professor
Educational Administration

John G. Harvey
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Professor
Child and Family Studies

Dale D. Johnson
Professor
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Herbert J. Klausmeier
V.A.C. Henmon Professor
Educational Psychology

Joseph T. Lawton
Assistant Professor
Child and Family Studies

Joel R. Levin
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Educational Psychology

James M. Lipham
Professor
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Dominic W. Massaro
Professor
Psychology

Donald M. McIsaac
Professor
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Wayne Otto
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Penelope L. Peterson
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Educational Psychology

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Curriculum and Instruction

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Gary G. Price
Assistant Professor
Curriculum and Instruction

W. Charles Read
Associate Professor
English and Linguistics

Thomas A. Romberg
Professor
Curriculum and Instruction

Richard A. Rossmiller
Professor
Educational Administration

Peter A. Schreiber
Associate Professor
English and Linguistics

B. Robert Tabachnick
Professor
Curriculum and Instruction

J. Fred Weaver
Professor
Curriculum and Instruction

Gary G. Wehlage
Associate Professor
Curriculum and Instruction

Steven R. Yussen
Associate Professor
Educational Psychology

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